PAGE'S WEEKLY.—December 8, 1905. Thin Paper Copy for Circulation Abroad.

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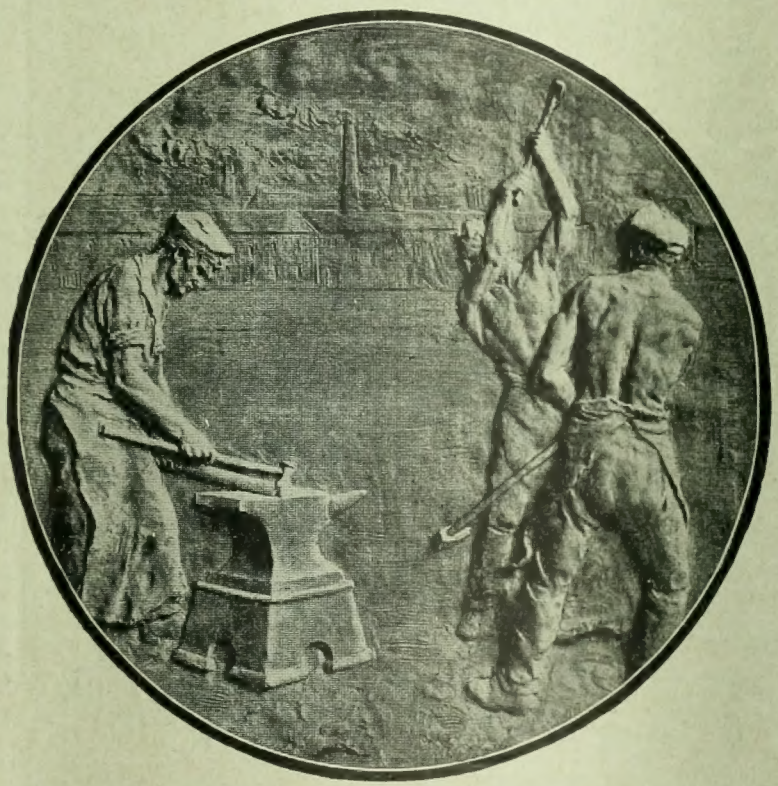
PAGE'S WEEKLY



ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

FRANCE, Paris: 22, Rue de la Banque.
GERMANY, Berlin: 13, Unter den Linden.
RUSSIA, St. Petersburg: 14, Nevsky Prospect.
ITALY, Rome: 307 Corso.
AUSTRIA, Vienna: Kärntnerstrasse, nr. 30.

INDIA, Calcutta: Thacker, Spink & Co.
" Bombay: Thacker & Co., Ltd.
SOUTH AFRICA, Cape Town: Gordon & Gotch.
JAPAN, Yokohama: Kelly & Walsh, Ltd.
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CANADA: Montreal News Company.
UNITED STATES, New York: International News Co.
" Chicago: Subscription News Co.
AUSTRALIA, Melbourne: Gordon & Gotch.
STRAITS SETTLEMENTS, Singapore: Kelly & Walsh, Ltd

PAGE'S WEEKLY

Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

19, OLD QUEEN ST., WESTMINSTER, S.W.

Telephone No.: 5754 Bank. Write for particulars.

MOULDERS' LETTERS AND FIGURES.

Marks, Name Stamps, Branding Irons, Sets of Letter and Figure Punches, Brass Labels and Time Checks, Embossing Presses, Dies and Seals, Brass Name Plates, Stencil Plates, India Rubber Stamps.

EDWARD PRYOR & SON,
68, West Street, SHEFFIELD.

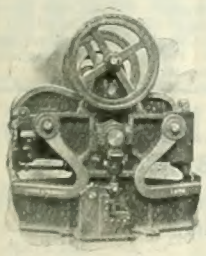
NEW BOILERS

READY FOR PROMPT DELIVERY.

	Size.	Working Pressure.
One Thompson Boiler,	30 ft. by 8 ft. 6 in.	for 160 lb.
Three ,, ,,	30 ft. ,, 8 ft. 6 in.	,, 120 lb.
One ,, ,,	30 ft. ,, 8 ft. 6 in.	,, 100 lb.
Three ,, ,,	30 ft. ,, 8 ft.	,, 120 lb.
Six ,,	30 ft. ,, 8 ft.	,, 100 lb.
One ,, ,,	28 ft. ,, 7 ft.	,, 140 lb.
One Cornish ,,	20 ft. ,, 5 ft.	,, 100 lb.

All sizes of Vertical Boilers from 2 to 20 n.h.p.

JOHN THOMPSON, Wolverhampton.



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.

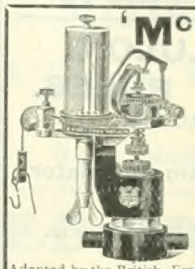
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS,
615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.
Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS

A. MOUNT-HAES,

M.I.Mech.E., M.I.M.E.,
Consulting and Mining Engineer for Ore Dressing Plants of All Classes.

11, IRONMONGER LANE, LONDON, E.C.
Tel. Address: "DRESSINGS, LONDON." Telephone No.: 272 Central.



'McINNES-DOBBIE' INDICATORS.

In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

Adopted by the British, French, and Japanese Admiralties.

DOBBIE, McINNES, LIMITED,
45, BOTHWELL ST., GLASGOW.

BABCOCK & WILCOX, Ltd.

PATENT WATER-TUBE BOILERS.

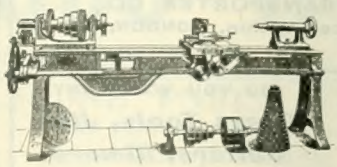
These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing Dec. 22nd, page 37.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.

WAYGOOD LIFTS

APPLY FOR CATALOGUE.

FALMOUTH ROAD, LONDON, S.E.

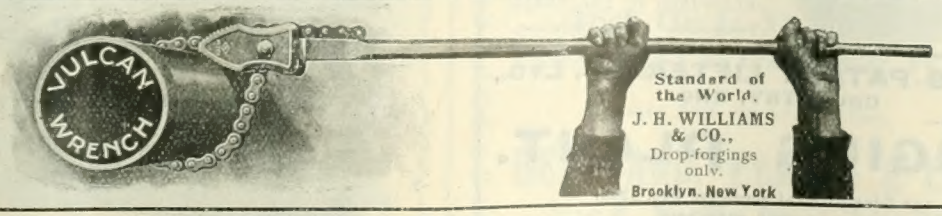


HIGH-CLASS
MACHINE TOOLS
In stock for immediate delivery.

THOS. W. WARD, Ld.
Albion Works,
SHEFFIELD.

HEAD, WRIGHTSON & CO., LTD.,

STOCKTON-ON-TEES,
for all kinds of
Colliery Plant & Mining Machinery.



Standard of the World.
J. H. WILLIAMS & CO.,
Drop-forgings only.
Brooklyn, New York

PAGE'S WEEKLY — Miscellaneous

I WANT A POSITION
as your Advertisement Manager.
SALARY REQUIRED 5/- PER ANNUM.

I will give my services FREE for the first month, if you will send a penny stamp to defray my travelling expenses.

The BRITISH ADVERTISER,
Queen Anne's Chambers, WESTMIMSTER, S.W.

CELLULOID SLIDE RULES.
UNIVERSAL DRAFTING MACHINE.

Piece Work, Balance and Premium Calculator.

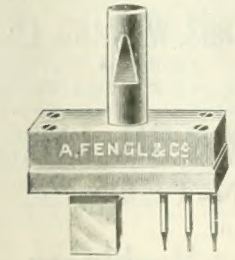
Send for Pamphlets on Drawing Instruments.

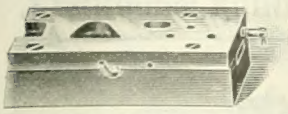
JOHN DAVIS & SON
(Derby), LTD.
30, All Saints Works, DERBY, &
36L, Camomile Street, LONDON, E.C.

FORTUNES IN WASTE
FIRE WOOD AND LIGHTER MACHINERY
M. GLOVER & CO., Patentees, LEEDS.

TRANSPORTERS.
See our Advertisement appearing Dec. 22nd.

TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo"





DO YOU WANT ANY
Press Tools, Jigs, Cutters, Rimers, Gauges?
If so, send your requirements, and

A. FENGL & CO.,
ALTRINCHAM,
will submit design and price.

Inventors' Models Worked Out and Manufactured.

STAMPINGS TO THE TRADE.
Telegrams: "Fengl, Altrincham."

BRETT'S PATENT LIFTER CO., LTD.,
COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing Dec. 22nd.
SEND FOR LATEST CATALOGUE.

A NEW GAUGE GLASS.
Samples, Lists, and Testimonials on applicatio

"S. H. P."
Tested to 350 lb. Steam Pressure.
For High Pressure Boilers.

WALTER SCOTT, LTD.,
LEEDS STEEL WORKS, LEEDS, ENGLAND.
MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: **TRAMRAILS.**

WEST PASCAGOULA CREOSOTING WORKS,
WEST PASCAGOULA, MISS., U.S.A.

Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C Code used. Cable address: Pierre, West Pascagoula, Miss.—Address, JNO. B. LINDSEY, Superintendent.

J. FREDK. MELLING,
14, Park Row, LEEDS, ENGLAND.

Iron & Steel Bars, Plates, Sheets, Girders, Channels, Angles, Rails, Blooms, Billets, & Slabs.

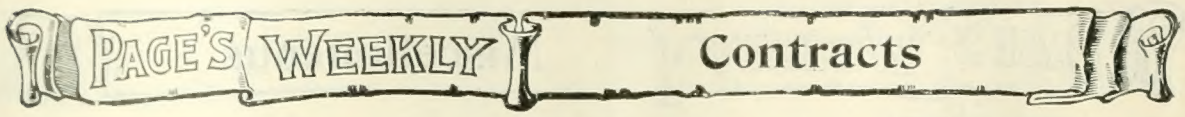
Write for Section Lists and Prices.

Telegrams: "LEGATION, LEEDS."

WINN'S

PAGE'S WEEKLY

Miscellaneous



CONTRACTS.

ELHAM UNION.—TO BOILERMAKERS, ETC.

The Guardians of this Union REQUIRE a LANCASHIRE BOILER.

Tenders are invited for the supply of same according to a Specification which can be obtained at my office as under, on payment of £1 1s. which will be returned on receipt of a *bona fide* Tender.

Tenders to be delivered at my office on or before Wednesday, December 27th.

The Guardians do not bind themselves to accept the lowest or any Tender.

R. LONERGAN,
Clerk.

11, Cheriton Place, Folkestone,
November 28th, 1905.

OXIDE SHED.

THE GAS COMMITTEE OF THE COVENTRY CORPORATION

invite TENDERS for the SUPPLY and ERECTION at their Foleshill Works of OXIDE SHED, 322 ft. long by 62 ft. 6 in. wide, formed of Cast Iron Columns and Steel Roof, covered with Corrugated Sheets.

Specification and Form of Tender, with Bill of Quantities, may be obtained on application to the undersigned, and prints of the drawings will be supplied on payment of One Guinea which will not be returned.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders must be delivered not later than the first post on Monday, December 18th, addressed to the Chairman of the Gas Committee, Gas Works, Coventry, and endorsed "Tender for Oxide Shed."

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas Works, Coventry.
November 20th, 1905.

HALIFAX CORPORATION WATER-WORKS.

WALSHAW DEAN RESERVOIRS.
CAST-IRON PIPES.

The Corporation of Halifax invite TENDERS for the SUPPLY of about 415 TONS of CAST-IRON PIPES, from 24 in. to 12 in. diameter, including irregulars.

Drawings and copies of the Specification, Schedule, and Form of Tender may be obtained on and after Monday, November 27th, 1905, at the offices of Messrs. G. H. HILL AND SONS, Civil Engineers, 3, Victoria Street, Westminster, and Albert Chambers, Albert Square, Manchester, upon deposit of cheque for One Guinea.

This sum will, after the Corporation shall have come to a decision upon the Tenders, but not before, be returned to the tenderer, provided that he shall have sent in a *bona fide* Tender, and shall not have withdrawn the same, and shall have returned the documents lent to him for the purpose of making up his Tender.

Sealed Tenders, endorsed "Tender for Cast-Iron Pipes," must be addressed to the undersigned on or before Monday, December 11th, 1905.

The person whose Tender is accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

Town Hall, Halifax,
November, 1905.

THE SOUTH INDIAN RAILWAY COMPANY, LIMITED,

is prepared to receive TENDERS for the SUPPLY of—

(1) GENERAL STORES—comprising hardware, iron, steel, metals, oils and colours, leather and rubber goods, electrical stores, and sundries;
(2) LOCOMOTIVE STORES—comprising copper and steel plates, tyres, axles, springs, brass and steel tubes and trollies;
(3) STATIONERY—comprising books, paper, envelopes, ink, and sundries;
(4) IRON WIRE FENCING—40 tons;
(5) ROOFING—5 roofs 100 ft. by 25 ft., 44 tons.

Specifications and Forms of Tender may be obtained at the Company's Offices, on and after Monday, November 27th, 1905.

Tenders, addressed to the Company, and marked "Tender for General Stores," or as the case may be, must be left with the undersigned not later than Twelve o'clock noon of Tuesday, December 12th, 1905.

The Company is not bound to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 20s. for each copy of Specification No. 1, and of 10s. for each copy of Nos. 2, 3, 4, and 5.

Copies of the Drawings may be obtained at the office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet.

By order,
HENRY W. NOTMAN,
Managing Director.

Company's Offices,
55, Gracechurch Street, London, E.C.,
November 24th, 1905.

BOROUGH OF MACCLESFIELD.

The CORPORATION are prepared to receive TENDERS for the SUPPLY of DRAIN PIPES, CASTINGS, CEMENT, BRICKS, IRONMONGERY, IRON and STEEL, TIMBER, HARDWOOD, PAINT and OILS, and DISINFECTANTS during the Year ending December 31st, 1906.

Forms of Tender can be obtained at the Borough Surveyor's office.

Tenders to be sent, addressed to the Chairman of the Highway Committee, Town Hall, not later than December 13th, 1905, marked outside "Tender for ——."

The Committee do not bind themselves to accept the lowest or any Tender.

(Signed) CHAS. W. STUBBS,
Borough Engineer.

November 23rd, 1905.

THE SOUTHERN MAHRATTA RAILWAY COMPANY, LIMITED.

The Board of Directors of the Southern Mahratta Railway Company, Limited, are prepared to receive TENDERS for

1,000 STEEL TYRES for Carriages and Wagons

as per the Specification and Drawing, which may be seen at the offices of the Company.

The charge for the Specification is One Guinea, which will not be returned.

Tenders must be sent in, addressed to the Secretary, marked "Tender for Steel Tyres," not later than Twelve o'clock noon on Tuesday, December 11th, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

By order of the Board,
EDW. Z. THORNTON,
Secretary.

46, Queen Anne's Gate, S.W.,
November 22nd, 1905.

CITY OF LAUNCESTON, TASMANIA.

ELECTRIC LIGHT DEPARTMENT.

TENDERS FOR SUPPLY OF METERS.

The MAYOR and ALDERMEN of the City of Launceston, Tasmania, are prepared to receive TENDERS for the SUPPLY of 500 or more ELECTRIC METERS and for MAXIMUM DEMAND INDICATORS.

Specifications and Conditions of Contract in duplicate may be obtained on application to Mr. WILLIAM CORIN, City Electrical Engineer, Launceston, Tasmania, or to Messrs. JOHN TERRY AND CO., 7, Great Winchester Street, London, E.C., England, on payment of Two Guineas, which sum will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tenders for Supply of Electric Meters," must be addressed to the undersigned and lodged in his office not later than 12 o'clock noon of Monday, the 15th day of January, 1906.

C. W. ROCHER,
Town Clerk.

Town Hall, Launceston, Tasmania,
September 25th, 1905.

ELHAM UNION.—TO MAKERS OF SUPERHEATERS.

The Guardians of this Union REQUIRE one or more SUPERHEATERS.

Tenders are invited for the supply of same, according to a Specification which can be obtained at my office as under on payment of £1 1s. which will be returned on receipt of a *bona fide* Tender.

Tenders to be delivered at my office on or before Wednesday December 27th.

The Guardians do not bind themselves to accept the lowest or any Tender.

R. LONERGAN,
Clerk.

11, Cheriton Place, Folkestone,
November 28th, 1905.

BOROUGH OF ST. PANCRAS.
CONTRACT FOR IRON ROOFING.

THE COUNCIL OF THE ABOVE

Borough invite TENDERS for the CONSTRUCTION of an IRON and SLATE ROOF over part of the Yard at the Destructor Depot, Georgiana Street, Camden Town.

Persons desiring to submit a Tender may inspect the Drawings at the Office of the Department of Works, Town Hall, Pancras Road, N.W., and may obtain a Specification, Bill of Quantities, Diagrams of the various roof trusses, and Form of Tender on application to the Borough Engineer, enclosing 10s. as payment for the same, not returnable.

Tenders upon a form which will be supplied, addressed to the Borough Engineer, and endorsed "Tender for Iron Roofing," will be received up to Five o'clock in the evening of the 11th day of December proxime.

The Council do not bind themselves to accept the lowest or any Tender.

By order, C. H. F. BARRETT,
Town Clerk.

Town Hall, Pancras Road, N.W.,
November 28th, 1905.

PAGE'S WEEKLY — Contracts and Appointments Open

BOROUGH OF BASINGSTOKE.

WATER SUPPLY—CONTRACT No. 2.

The CORPORATION of Basingstoke invites TENDERS for the SUPPLY, DELIVERY, and ERECTION of SUCTION GAS PLANT, GAS ENGINES, and PUMPING MACHINERY (all in duplicate) in connection with the New Waterworks.

Plans and Specification can be obtained from the Waterworks Engineer on payment of Three Guineas, which will be returned on receipt of a *bona fide* Tender and the return of all documents supplied.

Tenders, on the prescribed form only, endorsed "Pumping Machinery," must be delivered to the undersigned on or before Monday, the 11th December.

The Corporation does not bind itself to accept the lowest or any Tender.

F. REGINALD PHIPPS, Assoc.M.Inst.C.E.,
Waterworks Engineer.

Town Hall, Basingstoke,
November 13th, 1905.

CLYDE NAVIGATION. — TO CRANE, CAPSTAN, and TURNTABLE MAKERS, and ELECTRICAL ENGINEERS.

EQUIPMENT OF CLYDEBANK DOCK.

The Trustees of the Clyde Navigation invite TENDERS for :—

(1) One 20-ton Hand or Electric OVERHEAD TRAVELLING CRANE for the Electric Power Generating Station.
(2) Six Electrically driven QUAY CAPSTANS, and Two Electrically driven Double-geared PIERHEAD CAPSTANS, and
(3) Two Electrically worked TIPPING TURNTABLES.

Copies of the General Specifications and Forms of Tender may be had on application at this office to Mr. GEORGE H. BAXTER, the Mechanical Engineer, on payment of £1 1s. for each Specification, which will be refunded on receipt of a *bona fide* Tender.

Separate sealed Tenders, marked "Tender for 20-Ton Crane," "Tender for Electric Capstans," or "Tender for Electric Tipping Turntables," to be lodged with the undersigned not later than noon on Monday, December 18th.

The Trustees may not accept the lowest or any Tender.

T. R. MACKENZIE,
General Manager and Secretary.

16, Robertson Street, Glasgow,
November 22nd, 1905.

POPLAR UNION.—The Guardians of the Poor of the Poplar Union are prepared to receive TENDERS for the Supply and Erection of the following PLANT at the Children's Homes and Schools now in course of erection at Hutton, Essex :—

Section X. STEAM ENGINES, DYNAMOS, PIPEWORK, &c.
,, Y. Part 1. MAIN SWITCHBOARD, WIRING, MOTORS, &c.
,, ,, Part 2. FIRE ALARMS, TELEPHONES, and ELECTRIC BELLS.

Persons desirous of tendering may obtain the General Conditions, Specifications, and Schedules, and inspect Plans at the Offices of the Consulting Engineer Mr. ALBION T. SNELL, M.Inst.C.E., Suffolk House, 5, Laurence Pountney Hill, Cannon Street, E.C., between the hours of 10 and 4, on and after November 21st, upon depositing in notes or gold the sum of £10 for Section X. and £20 for Section Y, which sum will be returned upon receipt of *bona fide* Tenders.

Contractors will be required to pay all workmen employed the trade union rate of wages, and to observe the hours of labour current in the district.

Sealed Tenders upon the forms supplied, addressed to me, are to be delivered at these offices before six o'clock p.m. on Wednesday, December 13th, 1905, when they will be opened at a meeting of the Guardians.

The Guardians do not bind themselves to accept the lowest or any Tender.

G. HERBERT LOUGH,
Clerk to the Guardians.

Guardian's Offices, 45, Upper North Street,
Poplar, E., November 15th, 1905.

APPOINTMENTS OPEN.

CITY OF AUCKLAND, NEW ZEALAND.

APPOINTMENT OF CITY ENGINEER.

Applications, accompanied by Testimonials, will be received in the Town Clerk's Office, Auckland, New Zealand, until 4 o'clock p.m. on Thursday, February 8th, 1906, for the appointment of City Engineer to the City of Auckland. Conditions of appointment may be seen, and copies obtained, at the office of the High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W.

HENRY W. WILSON,
Town Clerk.

September 1st, 1905.

SOUTH AFRICAN COLLEGE, CAPE TOWN.

APPLICATIONS are invited for the Newly founded PROFESSORSHIP OF ELECTRO-TECHNICS in this College.

Age of applicants must not exceed 35 years.

Commencing salary £600 per annum.

Applications, with six copies of testimonials and health certificate, must be sent not later than December 15th, 1905, to the Agent-General for Cape Colony, 100, Victoria Street, London, S.W., from whom further particulars can be obtained.

LANCASHIRE COUNTY COUNCIL.

TO CIVIL ENGINEERS AND SURVEYORS.

The Lancashire County Council require the services of a competent person to act as DISTRICT SURVEYOR of main and secondary roads under the supervision of the County Surveyor.

The gentleman appointed will require to devote the whole of his time to the duties of his office.

The salary will be at the rate of £200 per annum, with biennial increments of £25 to a maximum of £300 per annum, and with such travelling expenses as are fixed by the Council. The appointment will be made subject to termination by three months' notice on either side. Candidates having had experience in Lancashire would be preferred.

Applications must be made in Candidate's own writing on a form to be obtained from the undersigned, stating age (which must not exceed 35 years) and past experience, and accompanied by copies of not more than three recent testimonials, and must be addressed to the undersigned, County Offices, Preston, marked "Main Road Surveyor," not later than Thursday, the 14th day of December, 1905.

Personal canvassing will be considered a disqualification.

HARCOURT E. CLARE,
Clerk of the County Council.

Preston, November 24th, 1905.

MALAY STATES.— TELEGRAPH INSPECTOR required for Federated Malay States. Candidates should have had experience on an English railway, and should be competent to erect and maintain telegraph and telephone lines, telephones, bells, block signalling instruments, single needle and other telegraph instruments. They should not be more than 30 years of age, and, preferably, unmarried.

Engagement for three years, with possible extension.

Salary £225 per annum. Half salary will begin from date of embarkation, full salary from date of arrival in the State to which he is sent.

Unfurnished quarters provided, if available, at a rent equal to 7½ per cent. of the same.

Free second-class passage out, and home again, on satisfactory completion of engagement, for self and for wife and for children (if any), not exceeding five persons in all. Strict medical examination.

Applications by letter (no special form required), stating age, married or single, number of children (if any), full particulars of experience, accompanied by copies of testimonials (not originals), with names and addresses of references of whom inquiries can be made as to capabilities and character, will be received by the Crown Agents for the Colonies, Whitehall Gardens, London, S.W., up to December 12th.

Quote M/2322 on top left-hand corner of letter of application.

MALAY STATES.—ELECTRICAL MECHANICIAN required for the Federated Malay States Railways.

Candidates should have a thorough practical knowledge of three-phase motors as applied to the driving of machine tools, woodworking machinery, cranes, traversers, shafting, &c., in a railway workshop.

The person engaged will require to erect and maintain the electrical plant at the Central Workshops of the Federated Malay States Railways, where the combined power of motors is about 350 h.p., the motors varying from 1 to 40 h.p. Candidates should not exceed 35 years in age, and should be, preferably, unmarried.

Engagement for three years with possible extension.

Salary £225 per annum. Half salary from date of embarkation, full salary from date of arrival in the State to which sent. Unfurnished quarters provided, if available, at rent equal to 7 per cent. of value of same.

Free second-class passage out and home again on satisfactory completion of engagement for self, and for wife and children (if any), not exceeding five persons in all.

Strict medical examination.

Applications by letter (no special form required) stating age, married or single, number of children (if any), full particulars of experience accompanied by copies of testimonials (not originals), with names and addresses of references of whom inquiry can be made as to capabilities and character, will be received by the Crown Agents for the Colonies, Whitehall Gardens, London, S.W., up to the 12th December.

Quote M/2235 on top left-hand corner of letter of application.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 22 and 24.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Band Sawing Machines.
Noble & Lund, Ltd., Felling-on-Tyne.

Bearings (Roller).
Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Boiler and Crank Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.
Thompson, John, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.

Cables.
Callender's Cable and Construction Co., Ltd.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Coke Oven Expert.
Mallmann, P. J., 110-118, Victoria Street, S.W.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 19, Old Queen Street, Westminster, S.W.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.
Mount-Haes, A., M.I.Mech.E., M.I.M.E., 11, Ironmonger Lane, London, E.C.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Copper and Brass.
W. Hepton & Son, Hunslet Lane, Leeds.

Coverings (Boiler).
Magnesia Covering Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne
Swift, George, Clarence Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 16, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
British Westinghouse Electric and Manufacturing Co., Ltd., Norfolk Street, Strand, London, W.C.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Ebonestos Manufacturing Co., 22, Rosoman Street, London, E.C.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Scott, E., & Mountain, Ltd., Newcastle-on-Tyne.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co. (*see* Ebonestos Manufacturing Co.), 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Cundall, Son & Co., Ltd., Airedale Iron Works, Shipley.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY

Miscellaneous

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Angus, G. & Co., Ltd., Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Swift, George, Clarence Ironworks, Halifax.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Buckley, Saml., St. Paul's Square, Birmingham.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds, England.
Flockton, Tompkin & Co., Ltd., Newhall Steel Works, Sheffield.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

Lathe Carriers
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Beanland, Perkin, & Co., School Close Works, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Dempster, Moore & Co., Ltd., 49, Robertson Street, Glasgow.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Resides, 12, Aire Street, Brighouse, Yorks.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Clarence Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3 London Wall Buildings, London, E.C.

Office Appliances.
Davis, J. hn, & Son, Ltd., 30, All Saints' W rks, Derby.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rookwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Oil Filters and Cabinets.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London E.C.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 35, Victoria Street, London, S.W.

Photographic Apparatus.

Marion & Co., Ltd., 22 and 23, Soho Square, London, W.

Pinch Bars.

Sanderson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Pneumatic Tools.

Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 33, Brook Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Mitchell, D., & Co. Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Riveted Work.

P. & A. Keep, Nixon & Co., Forward Works, Earl Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.
McTear & Co., Ltd., Newtownards Road, Belfast.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Slotting Machines.

Swift, George, Clarence Ironworks, Halifax.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and 100b, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes Co., 64, Mark Lane, London, E.C.

Typewriters.

Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hopkinson, J. & Co., Ltd., Britannia Works, Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North, Birmingham.
Scotch and Irish Oxygen Co., Ltd. Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Water Softeners and Purifiers.

Fraser & Chalmers, 3, London Wall Buildings, London, E.C.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.

Wells Light.

A. C. Wells & Co., 10A, Mornington Road, St. Pancras, London, N.W.

Wire Working Machinery.

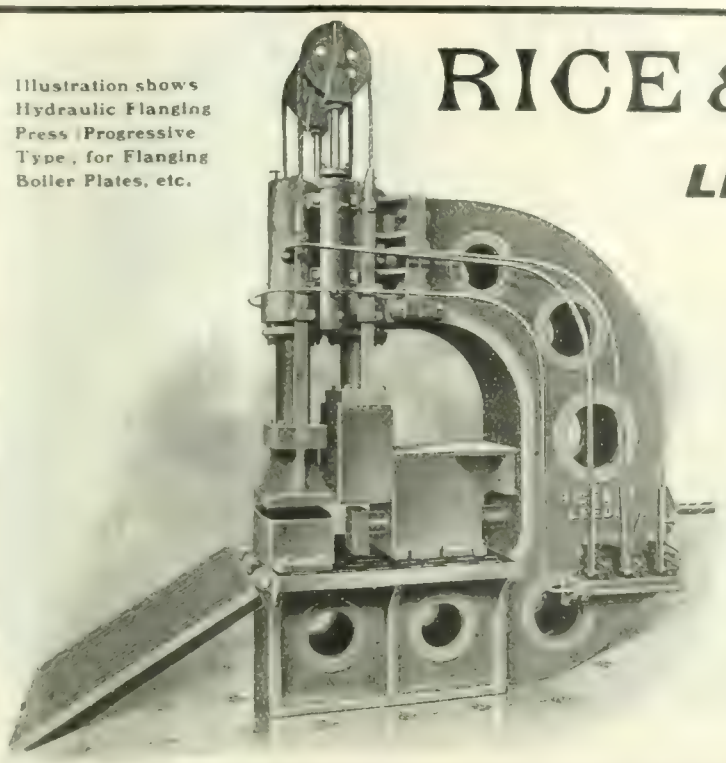
Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY — Machine Tools

Illustration shows Hydraulic Flanging Press (Progressive Type), for Flanging Boiler Plates, etc.



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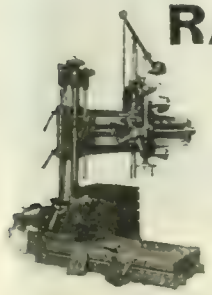

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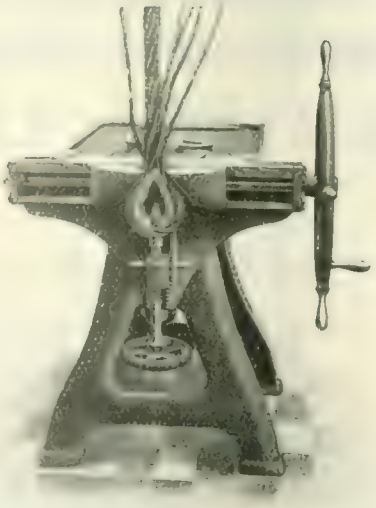

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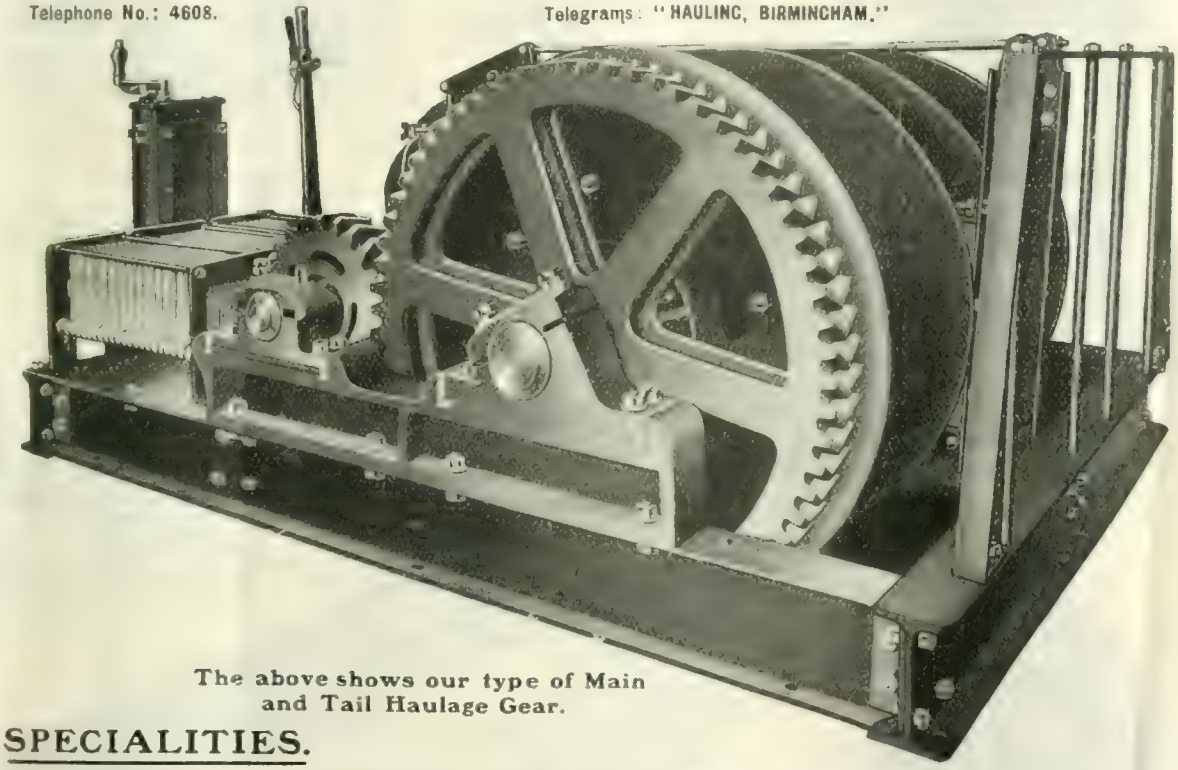

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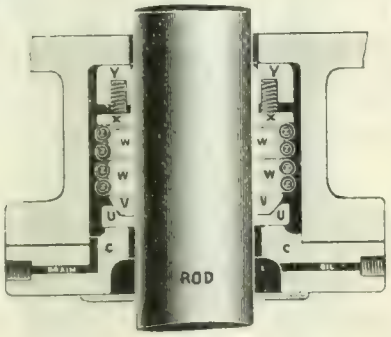
PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY — Packing, Belting, &c.



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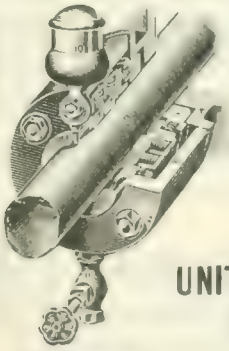

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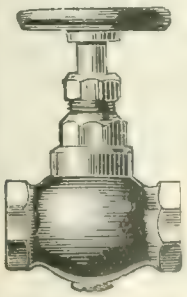

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Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

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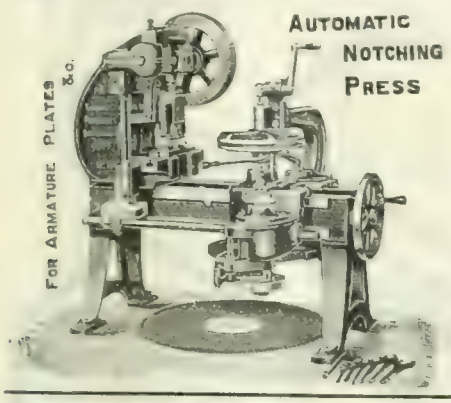
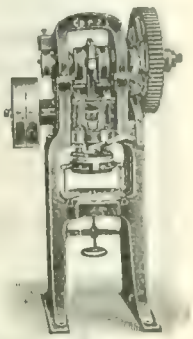
PAGE'S WEEKLY

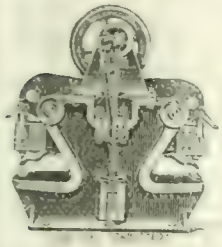
Miscellaneous





DRAWING PRESS.

MACHINE TOOLS



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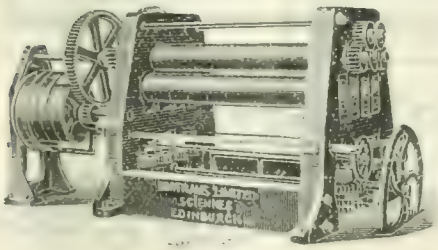

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PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, DECEMBER 8, 1905. No. 95

The Offices of "Page's Weekly," Wednesday Evening.

THE Council of the Iron and Steel Institute have arranged that the annual general meeting of the Institute shall be held in London on May 10th and 11th, 1906. In place of the usual autumn meeting a joint meeting with the American Institute of Mining Engineers will be held in London on July 23rd to 28th. It is intended during the week following to give the American visitors an opportunity of seeing some of the iron-making districts. It is anticipated that the visiting party will include many of the leading ironmasters who entertained the Iron and Steel Institute in America in 1890 and 1904. The Lord Mayor of London has consented to act as chairman of the London Reception Committee, and to give an evening reception at the Mansion House.

We are glad to place on record the fact that the highly sensational reports circulated immediately after the collapse of a portion of the roof at Charing Cross Station on Tuesday were much exaggerated, though it was responsible for a sad loss of life and numerous injuries. Sir Benjamin Baker was promptly called in to consult with the Company's chief engineer, Mr. P. C. Tempest, and a thorough investigation will be made in due course into the circumstances which brought about the accident. The station is 670 ft. long and 170 ft. wide. It has six platforms and six lines of rail, and is quoted by railway authorities as a good example of modern termini, though the approaches over the river have, of course, always been difficult to work. The roof was constructed in 1860 by Sir John Hawkshaw. At the weekly meeting of the London County

Photo, Elliott and Fry.

EARL CAWDOR, J.P., D.L.

Who is responsible for the important statement of Naval Reforms, dealt with on page 1255.

Council, Mr. Lewis Sharp asked the chairman of the Building Act Committee, whether the Council had any power of supervising these structures or any power to see that the public were safeguarded in the future. Captain Hemphill (chairman of the committee) said the Council had no control over buildings belonging to railway companies, and it was extremely desirable that they should have such control. The building was now under the observation of the officers who took proceedings with regard to dangerous structures, and the necessary steps were being taken to ensure the safety of the public.

Pending an inquiry, the most important evidence on the matter as yet available is to be found in the official account furnished by the General Manager of the South Eastern and Chatham line, Mr. Vincent W. Hill. This states that part of the roof at the river end of the station collapsed to the extent of 70 ft., and in collapsing thrust out a portion of the western wall and overturned it into the Avenue Theatre, which was undergoing rebuilding at the time. The glazing and sash-bars of the roof of the station were in progress of being renewed, but this had nothing to do with the collapse, which was apparently due to the breaking of a tie-rod, which was not affected by the works in hand, or to a settlement from some unknown cause which put an undue strain upon the tie-rod. The wreckage of the roof having fallen across the rails and completely blocked the access to the station it is impossible to work the trains to and from the same, and the station is, therefore, temporarily closed until the *débris* has been removed and the adjoining portion of the roof has been made secure.

The evolution of a satisfactory motor lifeboat is a matter necessarily attended with considerable difficulty, but the committee of the Royal National Lifeboat Institution have set their hands to the task with such good purpose that the new motor boats being constructed for use on the East and Scottish coasts, promise a considerable advance on what has hitherto been attempted. From information courteously placed at out disposal by the Secretary we learn that the first experimental motor-lifeboat was sent to Newhaven, Sussex, in November last year, where she won such golden opinions from the coxswain and crew that, when she was transferred to Tynemouth as the Station Lifeboat, the Newhaven men promptly asked to have their own lifeboat (a 37 ft. by 9 ft. 3 in. self-righting boat) fitted with a motor. This, of course, was a most encouraging sign that the institution was working on the right lines and that the efforts of the Committee and their officers were being applied in a profitable direction. In July last it was decided, after the report of the sub-committee, specially appointed to consider the question of motor lifeboats, had been received, to order three more motors, and also that the new lifeboats for Fishguard, Stronsay, Stromness, and Thurso should be specially designed as motor life-boats.

The three motors to be installed are as follows: The Walton-on-the-Naze lifeboat, of the Norfolk and Suffolk type, 43 ft. by 12 ft. 6 in., to be fitted with a 4-cylinder "Blake" motor of 40 b.h.p., making 550 revolutions, and approximate weight of 16 cwt.; diameter of cylinder, 5¼ in., length of stroke, 6¼ in. The Newhaven life-boat, self-righting type, 37 ft. by 9 ft. ; in., to be fitted with a 4-cylinder "Thornycroft," 24 b.h.p., 1,000 revolutions 4¼ in. diameter of cylinder and 5 in. stroke; approximate weight, 8 cwt. The Ramsgate lifeboat, of self-righting type, 42 ft. by 11 ft., to be fitted with a 4-cylinder "Briton" motor, 30 b.h.p., 900 revolutions, 5 in. diameter of cylinder, 5 in. length of stroke and approximate weight 8 cwt. In each of the three boats reversing gear will be used. Fitting these lifeboats for motors entails considerable structural alterations, which

have occupied a considerable time in carrying out, but as soon as all is completed, and the engines installed, a very interesting series of trials is anticipated. It is understood that the committee are still making experiments with a view to further overcoming special difficulties.

Mr. Mosely and his friends will doubtless read with interest a reference to the 1902 Mosely Commission which occurs in a paper just contributed by Mr. H. F. J. Porter of New York, to the American Society of Mechanical Engineers: "Mr. Mosely emphasised the advantage obtained in works by encouraging American workmen to use their brains, and by developing and utilising the enormous amount of expert knowledge possessed by the workmen, which was not only totally neglected in England, but absolutely suppressed by the attitude of the foremen, who feared that their positions would be in jeopardy if a workman showed that he had originality. *But Mr. Mosely and his party did not have time to stray very far from the beaten path, and saw principally the large and representative and successful plants. There are thousands which have not as yet advanced to the state he has described.*" The remark italicised presents a significant view of American industrial practice through home-made spectacles, and it will be seen that if English economists are dissatisfied with the conditions obtaining on this side of the Atlantic, they are not the only people with a grievance.

Mr. Porter, however, goes on to record that many American employers have recently experienced a change of sentiment and are seeking the co-operation of their employees. He also describes some of the means by which they are endeavouring to realise their ideals and to improve their organisation. In any manufacturing enterprise, he says, a standing committee on which both employees and management are represented, which meets at stated intervals, is an excellent method of "getting together." Before this committee all questions regarding systems of wage payments should come. Another facility, spoken of very highly, is the suggestion system now so generally adopted by the foremost concerns over there and also to some extent in this country. This system, it is claimed, develops in the workmen the power to observe, it improves their capacity of initiative and inspires their ambition. When the company pays well for valuable suggestions it is a paying institution both to the employee and the employer. The system may include suggestions from the employees regarding improvements in their own conditions of comfort and work.

Meetings of the foremen, says the author, should be held regularly, and instruction given to them in the proper handling and management of men to secure the best efficiency within the limits of fair and just treatment. It must be understood that in order to secure the best quality of work the mind of the worker must be as free as possible from worry about his position. Health, character, and intelligence in the order named are the essentials to be sought for in selecting an employee and when found should be fostered and improved. Apprenticeship schools in operation during working hours under the charge of a trained teacher are effective means of developing the mentality of the organisation and at the same time of getting in close touch with the employee early in his career, and the longer he stays with the concern and the more money is spent on his improvement, the more valuable he becomes as an asset and the greater the effort should be made to retain him in the organisation. It is quite refreshing to find an American writer paying so much attention to the "man behind the machine." He adequately sums up the human side of the equation when he says that a capable organisation can make the best of a poor equipment and produce good results,

whereas at the Admiralty organisation will not only fail to make a fine equipment productive of good work but probably in a short time will destroy the equipment itself.

The annual report of the Council of the Royal Society presented the other day placed on record a continued increased in the work of the National Physical Laboratory. The receipts for instruments tested, and experiments undertaken, rose from £4,000 in 1903 to nearly £6,000 in 1904. A total sum of £7,600 has been available for building operations during the year under review. Plans for a building for electrotechnical work were prepared by Messrs. Mott and Hay, and accepted by the executive committee. This building is now in course of erection. A large number of measurements have been made for this committee on the tolerances and allowances found in various classes of engineering work, and the results form a valuable report, which is now under the consideration of the committee. The ampere balance, constructed to the designs of Professor Avrton and the late Professor Jones, is now complete, and the preliminary results obtained with it are very satisfactory. The testing work in most of the departments has grown largely during the year, and some interesting results have been obtained. Progress has been made in various directions, but it is still slow in consequence of incomplete equipment.

Earl Cawdor, whose portrait appears on page 1247, enjoyed the sweets of office as First Naval Lord for a very brief spell. Our readers will remember that it was only a few months ago that, in order to assume that honour, he resigned the chairmanship of the Great Western Railway, a position he had held since 1895. Born in 1847, he was educated at Eton, and subsequently graduated at Christ Church, Oxford. His political career began in 1874, when he was elected M.P. for Carmarthenshire. In 1892 he contested South Manchester against Sir Henry Roscoe, and at the following Parliamentary election he was the opponent of Lord E. Fitzmaurice. The statement of naval reforms just issued under his signature is referred to in another part of this journal.

OBITUARY NOTICES.

[illegible] Capt. W. R. Cato recalls the fact that he was Chief Officer of the Great Eastern during the laying of the 1874 Atlantic cable. Of late years Capt. Cato had been marine superintendent of the Telegraph Construction and Maintenance Company's fleet. The death is also reported of Mr. Frederick [illegible] Beswick, who for many years acted as hydrographer to the Telegraph Construction and Maintenance Company.

Mr. Harry Wilkes Chubb, whose death at the comparatively early age of 48 is reported as the result of an accidental fall on stone stairs at the Colonial Office on Friday night, was the third son of John Chubb, of Brixton, and grandson of Charles Chubb, of Portsmouth and London, the inventor and patentee of the well-known Chubb lock. He occasionally lectured on subjects connected with [illegible] work, and he was an Associate of the Institution of Civil Engineers.

The death has taken place, in his seventy-third year, of Sir Henry Charles Fischer, C.M.G., late Controller of Telegraphs. When the State took over the telegraph in 1870 Sir Henry Fischer was instructed by the Postmaster-General to organise the staff and other arrangements of the Central Telegraph Office, and he was for many years, before his retirement in February, 1898, controller of this department.

Mr. Albert J. Pitkin, whose name was well known in connection with the Schenectady Locomotive Works, was associated with locomotive engineering during the whole of his business career, and his death recently in New York is a distinct loss to the profession. He was for some time in the drawing office at the Baldwin Works, afterwards becoming chief draughtsman of the Rhode Island Locomotive Works. He then became successively mechanical engineer of the Schenectady establishment, vice-president and general manager. When the American Locomotive Company was founded he was its first vice-president, and for the past two months had been president of the company.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No. 417 GERRARD
Telegraphic and Cable Address "SINEWY, LONDON"

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

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Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

MEETINGS, ETC., FOR THE ENSUING WEEK.

FRIDAY, DEC. 8.—Institution of Electrical Engineers, Annual Dinner at Hotel Cecil, 7.30 p.m.—Manchester Students' Section, Municipal School of Technology, Manchester, 7.30.—Paper "The Electrification of Existing Steam Railways," Mr. W. H. M. Parr.

SATURDAY, DEC. 9.—North of England Institution of Mining and Mechanical Engineers, 2 p.m.—Institute of Electrical Engineers (Dublin Section), Royal College of Science, Dublin.

MONDAY, DEC. 11.—Institute of Marine Engineers, Romford Road, Stratford, 8 p.m.—Paper "Some experiences with CO. Cylinders," Mr. R. Mackenzie.—Institution of Electrical Engineers (Newcastle Section), Armstrong College, Newcastle.—Society of Arts, 8 p.m.: Canton Lecture (II.) Dr. Fleming on "High Frequency Currents."

TUESDAY, DEC. 12.—Institution of Civil Engineers, Great George Street, at 8 p.m.—Adjourned discussion on "The Steam Turbine"—Institution of Electrical Engineers (Glasgow Local Section), 207, Bath Street, Glasgow; (Manchester Local Section), University, Manchester.

WEDNESDAY, DEC. 13.—Institution of Electrical Engineers (Birmingham Local Section and Leeds Local Section.)—Wolverhampton and District Engineering Society, 7.30 p.m.—Paper "The Locomotive of to-day." Mr. Geo. Bulkeley.

FRIDAY, DEC. 15.—Institution of Mechanical Engineers, Storey's Gate 8 p.m.—Adjourned discussion on the seventh Report to Alloys Research Committee.

NEWS ITEMS.

Great interest attaches to the maiden voyage to New York of the Cunard steamer Lusitania, which commences to-morrow.

There are at present on the Canal to-day, awaiting erection, shipped or on order, fifty-nine tube mills. Thirteen of these are already at work.

The municipality of Berlin, Germany, have decided to build an underground railroad from the north to the south of the city. The line will be electrical, and will be operated by the city.

From the 15th inst. the penny post is to extend to Egypt and the Soudan. From that date letters posted in the United Kingdom for those countries need no longer be prepaid at the foreign postage rate of 2½d. the half-ounce. The postage will thenceforth be 1d. the half-ounce.

In the course of his annual address to the American Society of Naval Architects and Marine Engineers President F. T Bowles remarked that at present their shipbuilding is in a satisfactory condition only on the great lakes. There the shipyards are busy, and steady improvement is made in the economy of transportation by the development of terminal facilities and the use of larger vessels.

The board of consulting engineers has recommended by a vote of eight to five, that the Panama Canal be built at sea level. The estimated cost is about $[illegible] as against [illegible] estimated at about $[illegible] for a canal with locks at a 60 ft. level. The difference in time for building the sea-level canal is estimated to be only two or three years more than for the canal with high-level locks.

CONTENTS.

The Magnet in Shop Work.

The use of magnets in shop operations has been too recent to predict the possibilities in store for the future. According to the Railway Master Mechanic, enough is known about its labour-saving properties to make its position secure as an adjunct that will not readily be dispensed with where once in use. Lifting magnets have been found of immense service in boiler shops for handling plates. They are used for loading and unloading scrap material, and at a lower expense than by any other method. The magnetic chuck for holding small pieces of work on the platen of a planer or grinding machine, is one of the most convenient devices ever got up, in fact, some thin jobs cannot be properly trued up in any other way. For such work, the current from an incandescent light circuit is sufficient to not only hold a job to the platen for grinding, but will also furnish resistance to a fair finishing cut from a tool, and do this without danger of shock to the operator. It therefore furnishes a solution to handling many intricate jobs that require to be true, and at the same time presents an opening to do such work on the ordinary shop tool.

Birmingham Association of Mechanical Engineers.

The annual meeting of this association was held at the Grand Hotel, Birmingham, on Saturday last. The president (Mr. R. Holliday) occupied the chair, and there was a large attendance of members. Messrs. W. Playdon and F. J. Cook gave interesting reports of their visits to the annual dinners of the Newcastle and Woolwich Associations, a vote of thanks being awarded to them for their services. Officers were elected as follows: Mr. F. H. Dykes president, vice Mr. R. Holliday; Mr. A. Cooke, vice-president, vice Mr. T. H. Dacres; Mr. C. Y. Hopkins, treasurer, vice Mr. A. Cooke. Messrs. W. Deakin, W. H. Dugard, F. A. Dowson, H. J. Grant, and J. Bettany were elected council members, Mr. T. E. Mitton as trustee, Mr. G. Thompson as auditor, and Messrs. L. O'Brien and W. Playdon were re-elected as secretary and assistant secretary.

STEAM HEAD MACHINED FROM SOLID MILD STEEL.
(See page 1254.)

Thames Steamboats.

At the weekly meeting of the London County Council the Rivers Committee recommended that the steamboat service be further altered, so that until March 31st the boats should run between Blackfriars pier and Greenwich pier at intervals of twenty minutes on weekdays and and half-an-hour on Sundays. Mr. Gilbert (chairman of the committee), in submitting the report, pointed out that if they closed the service altogether and suspended the men, the chief engineer would not undertake the service next year unless the men had a month's training. He appealed to the Council to consider these men, for they were under a debt of honour to give them winter employment. Lord Elcho moved an amendment that the service be suspended during the winter. On a division the voting was:—For the amendment, 41; against, 61; majority against, 20. The recommendation was then carried by 64 votes to 50.

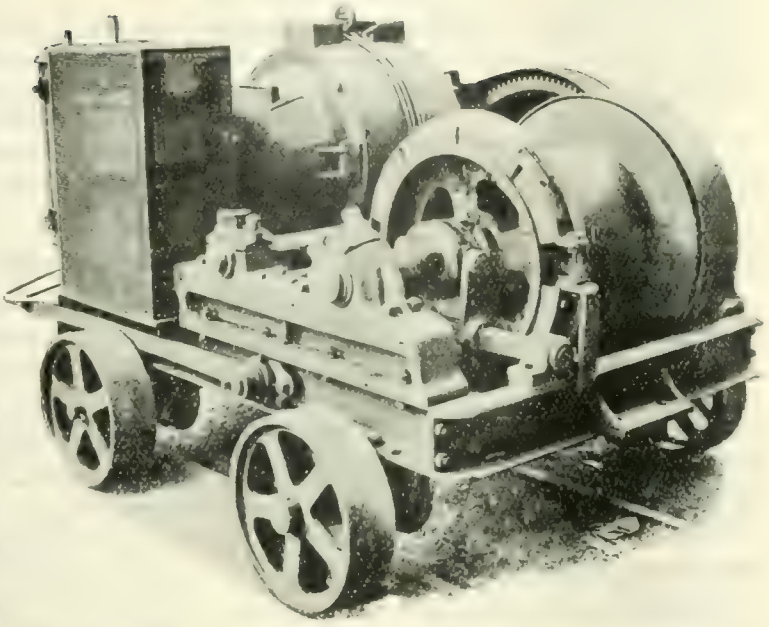
Agricultural Machinery at an Exhibition.

At Stand 28 at the Smithfield Club Show, held this week at the Agricultural Hall, Messrs. John Fowler and Co. (Leeds) Ltd., have an attractive exhibit of steam ploughing engines, road locomotives, agricultural traction engines, etc. The demand for double-crank compound spring mounted road locomotives during the year has again been heavy, and two such engines are exhibited, of Class "R 1 Type," illustrated on page 1271. These engines have been specially designed to meet the requirements of road authorities. They combine a minimum of size and weight with a maximum of power. The boiler carries a working pressure of 180 lb. per square inch. The full expansive force of high pressure steam is utilised, effecting a 30 per cent saving in fuel and water and a corresponding saving in the life of the firebox and boiler.

The Tramways and Light Railways Association will pay a visit to Lots Road Power Station on December 14th. At a meeting at the Society of Arts, on the evening of that day, a paper, "Improvements in Trucks," will be read by Mr. Elmer E. Cook.

Maccabæan Society.

A scientific dinner will be given by the Maccabæan Society (Prof. Meldola, F.R.S., vice-president, in the chair) on December 11th, at the Holborn Restaurant when the following representative men of science, distinguished in every field, Fellows of the Royal Society, will be the guests of the Society: The Duke of Northumberland (president of the Royal Institution), Sir William Huggins (past president of the Royal Society), Sir Archibald Geikie and Prof. Larmor (secretaries of the R.S.), Mr. Kempe (treasurer, R.S.), Sir William Crookes, Sir William Ramsay, Sir James Dewar, Sir Michael Foster, M.P., Sir John Evans, Prof. Tilden, Prof. Ayrton, Dr. W. H. Perkin, Prof. Ray Lankester, Prof. Poulton, Prof. Marshall Ward, Prof. Silvanus Thomson, Professor Dalby, Prof. H. E. Armstrong, and Major Macmahon. Mr. Haldane, K.C., M.P. (president of the British Science League), the Archdeacon of London and Mr. H. de Mosenthal, Mr. Otto Hehner, and Mr. John Greenaway will also be present.



PORTABLE ELECTRIC HAULAGE GEAR BY THE GENERAL ELECTRIC COMPANY, LTD.

The above illustration shows a portable electric haulage gear of the single drum type by the General Electric Company, Ltd., for hauling coal trucks or the like up an incline. The drum is driven by a continuous current motor on the shaft of which is placed a pinion gearing into a spur wheel, and a band brake actuated by a foot lever.

The Institution of Civil Engineers.

At the ordinary meeting on December 5th [illegible] Sir Alexander Binnie, President, in the chair, the paper read was "The Steam-Turbine," by the Hon. Charles A. Parsons, C.B., F.R.S., and G. G. Stoney, MM.Inst.C.E. The following is an abstract of the paper:—

The evolution of the steam-turbine is traced from the time of Hero, of Alexandria, following the chief steps in development that have led to the types in present use. Then the general theory of the working of the steam turbine is given, and the chief features of the flow and expansion of steam and the conditions essential to economy are touched upon.

After describing and discussing the chief characteristics of the three types of steam-turbine which practically cover the whole field of useful turbine inventions, viz.: the Parsons Turbine, introduced in 1884, the De Laval Turbine, in 1888, and the Curtis Turbine in 1902. The development of the Parsons Turbine is dealt with.

The importance of [illegible] to the economical working of steam-turbines is urged, and the authors point out certain special conditions and arrangements which must be observed in order to obtain a vacuum of [illegible] in. to 29 in. A new apparatus called a vacuum augmenter is described, which has been designed by the authors, and which consists of a steam jet placed in a convergent [illegible] the condenser and the air-pump. With this apparatus, a total net reduction of steam-consumption of about 8 per cent, at full load has been obtained. Various applications of steam-turbines for driving pumps, and for working fans for colliery ventilation and blast furnace work are then briefly alluded to. Another application is the propulsion of [illegible] in large towns.

The remainder of the paper deals with the application of the steam-turbine to marine propulsion.

Mineral Survey in China.

The "North China Herald" states that according to a Peking letter, the Shangpu, having received from the Viceroy of Nanking an exhaustive report on the mineral resources of the Liangkiang Vice [illegible] Kiangsu, Kiangsi and Anhui Provinces

[illegible] Governors [illegible] them also to establish [illegible] department of mines which shall without delay make a careful and detailed survey of the mineral deposits of each province, mark out their respective boundaries, and earmark all places in which there may be the least indication of minerals or other product of commercial value. After this has been done permission must be obtained from the department of mines before any person or persons is allowed to develop such deposits. These departments, on the other hand, will be required to send periodical reports to the Shangpu for record, with maps and general remarks on each newly-opened mine or mines that come under the department's notice. In this manner it is thought that the Imperial Government will be able to know without trouble just how many mineral deposits are in the country and how they are being developed.

New Design of Steam Tees.

The question of the employment of wrought-steel for tees and other fittings has received considerable attention at the hands of Messrs. Meldrum Bros., Ltd., in connection with the production of their steam raising destructors. The new registered design of steam tees herewith illustrated, machined from solid mild steel, represents a new departure which the firm have adopted for manufacture, after satisfying their own requirements. It is claimed that these fittings offer an important advance on castings of iron, gun metal, or steel, especially for high-pressures and superheated steam, while they also take up less space than the ordinary pattern.

Royal Society.

In relinquishing the chair of the Royal Society to his successor, Lord Rayleigh, Sir William Huggins, the eminent physicist, sketched the progress of scientific knowledge as told in the history of the Royal Society. He said that the Society was a chief practical outcome of a new spirit, a conviction of the necessity, in the study of nature, of an appeal to nature herself by means of direct experiment. In the early years of Queen Victoria's reign, the accumulated tension of scientific progress burst upon the mind, not only of the nation, but of the whole intelligent world, with a suddenness and an overwhelming force for which the strongest material metaphors were poor and inadequate. One of the most important and fruitful results of this intellectual upheaval was the almost unlimited [illegible] which we enjoyed to-day. It was the glory of experimental science that it was for ever seeking further truth in all directions, and was always ready to change its opinions into agreement with the newest knowledge whithersoever it might lead, which it was able to wrest from nature by experiment. To sum up, the influence of science during the last fifty years had been in the direction of bringing out and developing the powers and freedom of the individual under the stimulation of great ideas.

Medals Awarded.

The President then proceeded to the award of the medals. The Copley medal was awarded to Professor Dmitri Ivanovitch Mendeleeff, For. Mem. R.S., for his contributions to chemical and physical science. Professor Mendeleeff, born at Tobolsk, in Siberia, in 1834, stood high among the great philosophical chemists of the last century. A Royal medal was awarded to Professor John Henry Poynting, F.R.S., on account of his researches in physical science especially in connection with the law of gravitation and the theories of electro-dynamics and radiation. The other Royal medal was awarded to Professor Charles Scott Sherrington, F.R.S., for his work on the central nervous system, especially in relation to reflex action. Professor Sherrington had, said the President, published a series of papers upon the structure and function of the brain and spinal cord. His researches had dealt with a number of subjects cognate with that of the central nervous system. The Davy medal was awarded to Professor Albert Ladenburg on account of his resarches in organic chemistry, especially in connection with the synthesis of natural alkaloids. The Hughes medal was awarded to Professor Augusto Righi for his experimental researches in electrical science, including electric vibrations. Professor Righi had been for many years a prominent and active worker in the sciences of light, electricity, and magnetism.

The Birmingham City Council on Tuesday adopted, by a large majority, the recommendation of the gas committee, in favour of large consumers of town gas for power purposes, reported last week.

The Cargo Fleet Iron Company, who installed their first Talbot steel furnace eleven weeks ago, will have another furnace of the same pattern ready in the course of a few days, whilst a third one will be completed next spring. These furnaces are stated to be the largest of their type in the world.

ADMIRALTY REFORMS.

THE STATUS OF THE ENGINEER OFFICER.

THE very important blue-book issued during the week and signed by the First Lord of the Admiralty gives a retrospective view of the remarkable changes which have been brought about in the Navy during the past three years. The abstracts which follow, including the published financial statements, will be sufficient to show that the policy of the Admiralty has been emphatically one of efficiency with economy, and of particular interest to engineers are the paragraphs relating to the question of specialisation. In addition to Earl Cawdor's official statement, the blue-book includes a series of notes dealing successively with questions relating to personnel, fleet reorganisation, obsolescence of warships, dockyard reorganisation, and the estimates committee.

The following is an abstract of the Memo-

While [illegible] sight, perhaps, not very closely connected, the series of reforms that have been undertaken by the Admiralty during the past three years are all related and interdependent, and have their foundation in the reorganisation of the personnel and in the redistribution of the Fleet described in the two statements issued in 1902 and 1904. The reconstitution of naval education brings about far-reaching effects on the period of service and the allocation of officers, and re-acts again on the entry and organisation of the seamen, stokers, and marines. The release of crews from ships which would not be of value in war, has made it possible to man the Reserve ships with permanent crews, thereby largely increasing their efficiency, and consequently their instant readiness for war. The formation of a Reserve Fleet ready for immediate service allows of a more advantageous distribution of the sea-keeping fleet and of a better system of training for the Royal Naval Reserve. The elimination of the older vessels, which require the most frequent overhaul and repair, greatly reduces the work [illegible] allows of a reorganisation of the labour conditions.

DEVELOPMENT OF THE NEW SYSTEM OF ENTRY AND TRAINING OF OFFICERS.

It will be remembered that in order to provide for the new cadets during the first two years of their training at the age of from twelve to fourteen, a new college was built at Osborne, and a new system of education and training has there been inaugurated with great success.

The progress of the cadets during their first two years has been most carefully watched, and at the close of this period the Board felt that the experience gained warranted them in instituting a detailed inquiry into the probable future development of the new officer.

The Board has been convinced that there will be no need for a final division into three branches, and that specialisation for a period only is necessary, as opposed to permanent classification into separate lines. There can be no question of the great advantage to the efficiency of the Service that this removal of [illegible]

ENGINE-ROOM WATCH KEEPING.

It has long been felt that the stoker class should have better opportunities of advancement, and in the memorandum of December, 1902, the creation of the new

chief petty officer rating of mechanician, to be filled from the stoker class, was announced. Further consideration of the various duties in the stokehold and engine-room led the committee to recommend that in future the highly-trained engine-room artificer class should not, as heretofore, be called upon to undertake ordinary watch-keeping duties, but should be enabled to devote all their time to their real calling of artificers, and that watch-keeping duties should be undertaken by men selected from the stoker ratings after a suitable course of instruction.

ROYAL NAVAL RESERVE.

The arrangements for the drill and training of men of the Royal Naval Reserve have been recently reviewed in order to improve the efficiency of this branch of the Reserves, and also to reduce its cost.

NON-CONTINUOUS SERVICE.

The development of the non-continuous service system of entry of seamen, as a supplement to, and partial substitute for, the continuous service system, which has been almost universal for fifty years, is described in a separate note. The continuous service plan is very costly, but is still required for the production of the higher gunnery and other skilled ratings of the Fleet.

There are, however, a great number of men who do not need this expensive training, and can profitably be passed. after a shorter period of service, into the Royal Fleet Reserve.

CHANGES AFFECTING THE PAY OF THE MEN OF THE FLEET.

A provision allowance of 8½d. a day is to be paid to warrant officers, seamen, and marines on ship's books who are away on leave beyond forty-eight hours. This privilege, or its equivalent, is already enjoyed by soldiers and marines on shore strength, and will take effect after September 30th next.

Men making monthly allotments of money from their wages to their relatives at home, in the case of foreign stations, will not be compelled to have a portion of their wages retained in hand as a security against loss by death, desertion, etc.

In 1903, it was decided to recognise the value of the services of chief petty officers by the award of improved pensions, the estimated ultimate additional expense [illegible].

REORGANISATION OF RESERVE OF SHIPS.

The plan for the substitution of Reserve Squadrons, manned by nucleus crews and stationed at each of the three home ports, for the old "Fleet Reserve" system, as described by Lord Selborne last December, has proved completely successful, and all the ships now in the fighting line are always ready for sea.

At the same time the list of the Navy has been reduced by the removal of nearly 150 ships of all descriptions which had but a small fighting value.

The elimination of older ships permits the whole of the War Fleet to be manned with active service ratings, with the exception of stokers, all of whom can be provided from the Royal Fleet Reserve with the exception of 600 men. It is expected that in the course of the year a large proportion of the active service stokers needed will be obtained.

THE DISTRIBUTION OF SHIPS AMONG THE FLEETS.

To-day people are apt to look on a definite number of ships on any given station as a fixed quantity rather than a strategic exigency. This idea must be entirely dispelled. Squadrons of varying strength are strategically required in certain waters; but the kaleidoscopic nature of international relations, as well as variations or new developments in sea-power, not only forbids any permanent allocation of numbers, but in fact points the necessity for periodic redistribution of ships between our Fleets to meet the political requirements of the moment.

Since the redistribution of the Fleet described by the late First Lord in his memoranda of December 6th, 1904, and March 15th of this year, the following are the chief changes that have taken place: The strength of the Channel Fleet has been increased to seventeen battleships. The strength of the First and Second Cruiser Squadrons has been completed to six armoured cruisers of the latest type in each case.

A squadron of three cruisers has been employed in connection with the settlement of fishery questions in Newfoundland, and is now leaving for an extended cruise down the coasts of North and South America and back by the West Coast of Africa, and the cruisers *Cambrian* and *Flora* are about to proceed on a prolonged cruise on the Pacific Coast and the adjacent islands. The Board attach much importance to the provision of repair ships to attend the squadrons at sea.

MANŒUVRES.

The grand manœuvres have been arranged to take place in June next, when in association with the putting to sea of every fighting vessel, large and small, intended to be used in war, there will be an extended test made as to the scheme recently elaborated for the protection of trade, when the co-operation of the shipping interest is hoped for in elucidating this difficult problem.

SHIPBUILDING POLICY.

Before deciding on the building policy of the present year, [illegible] of our naval position as

regards other Powers had to be made. It must be remembered that, however formidable foreign shipbuilding programmes may appear on paper, we can always overtake them in consequence of our resources and our power of rapid construction.

Rapid shipbuilding is of great importance. At the present time strategic requirements necessitate an output of four large armoured ships annually, and, unless unforeseen contingencies arise, this number will not be exceeded. The period of building is to be two years, and therefore four ships will be laid down each year, and there will be eight ships in course of construction in any one year either in the dockyards or by contract.

The Board have come to the conclusion that the right policy is to make out their programme of shipbuilding for the next year only, and, while they anticipate at present that the output of four large armoured ships a year should suffice to meet our requirements, there would be no difficulty whatever in increasing this output to whatever extent may be necessary in consequence of any increase of naval power abroad

NAVAL EXPENDITURE.

The Navy Estimates as now presented yearly to Parliament must not be looked on only as the cost of our first line of defence. They also include the cost of many subsidiary services, some of which only indirectly affect the Navy, such as, for instance, fishery duties, scientific services, and the work of the Coastguard. These absorb about £1,000,000 of the money included in the Navy Estimates.

EFFECT OF ECONOMIES.

Earl Cawdor concludes as follows: The whole of the recent reforms have an effect on the Navy Estimates. The elimination of older ships reduces the number of men required; it permits us to keep the Navy up to the most modern requirements, while limiting the charges incident to increase of numbers. The reduction of the smaller establishments abroad has made possible considerable saving in stores and maintenance charges. With the condemnation of old ships, obsolete guns and armaments disappear; consequently magzaine accommoeation on various stations for innumerable classes of ammunition is no longer necessary, the maintenance of plant for repairing and altering types of guns and munitions is no longer required, and the space vacated can be devoted to more useful purposes, thus saving new expenditure on works.

The new educational scheme will give naval officers f the future an adaptability for the duties of all the branches of their calling, which will make possible a ertain reduction in the number of officers as compared with present requirements

ADMIRAL SIR JOHN ARBUTHNOT FISHER G.C.B., O.M.

Whose promotion to the rank of Admiral of the Fleet has just been announced. This distinction means that the country may anticipate the benefit of Sir John Fisher's retention on the active list of the Navy for some years to come.

The development of the non-continuous service system for seamen, and the restriction of re-engagement for pension to the higher ratings, will effect considerable savings on the non-effective votes for pensions. The entry of non-continuous service men will effect a saving in the costs of early training.

I have recently received the report (given in a separate note) of a committee I appointed to consider the Estimates for 1906-7, and I am able to say that these various economies will allow the Board to diminish the sum for which Parliamment will be asked by a further £1,500,000 beyond the £3,500,000 reduction made last spring.

I am bound, however, to add a word of caution, for the public cannot rely on this reduction being continued in future years if foreign countries make developments in their shipbuilding programmes which we cannot now foresee, but the programme of shipbuilding we have in view for future years, and have provided for, will, in the opinion of the Board of Admiralty, meet all the developments of which the resources of foreign countries seem at present capable.

THE EDUCATION OF OFFICERS.

We [illegible] the following from the note devoted to [illegible] officers:

Now that sufficient experience of the working of the new system has been obtained, it is desirable that definite regulations for future procedure with regard to the allocation of officers to the various branches of the service should be formulated and promulgated at the earliest possible moment. This question has received earnest consideration, and, so far as concerns those entered under the new system, it has been decided that all executive, engineering, and marine duties will be performed by executive officers of common entry and training, who will specialise for the different duties without separating into permanent and distinct branches. The consequence of this development of the original proposals is that there will be in future only one class of officer in all departments, and, whether performing engine-room, marine, gunnery, torpedo, or navigation duties, all will be equal and all will be executive officers. Each of these specialist officers will have special knowledge in one particular branch, but all will have a general knowledge of the duties of the other branches, and all will have the opportunities of fitting themselves for the position of captain of a ship, and hence of rising to the highest eminence in their profession.

The successful engineer or marine officer will have equal chances and the same claims to promotion as a successful gunnery or torpedo officer, if his general efficiency is as great: if inefficient, he will equally suffer.

Special knowledge of engineering or military duties no more debars an officer from obtaining the qualifications necessary to the command of a ship or a squadron than does expert acquaintance with gunnery, torpedo, or navigation, provided that the early training in command and responsibility, which has always been given to officers who undertake the latter duties, is also extended to those who will carry out the former, and provided also that whilst performing specialist duties as lieutenants or commanders, all officers are given ample opportunities of maintaining their executive efficiency. There is, thus, no necessity for the permanent distribution of officers who will undertake ordinary duties in sea-going or harbour ships and establishments into executive, engineer, and marine branches; one class of officer can be instructed so as to perform any of these duties.

THE COMMAND OF A FLEET.

Probably every cadet who enters the Service does so with the ambition of rising to the command of a fleet, and, though it is certain that very few can actually attain to this position, it can hardly be expected, nor is it right to expect, that even a small proportion of these young officers will, at the commencement of their careers as commissioned officers, voluntarily relinquish that ambition and join a branch which would preclude all possibility of rising to command. Thus, if separation became permanent at an early age, the best of the officers probably would select the executive branch, and the other branches would be filled by those less capable. Alternatively, if the choice were made by the Admiralty, and not left to the officers, the other branches would be filled by the remainder whether they wished it or not.

ENGINEER OFFICERS.

No fear need exist that the standard of engineering knowledge will be short of that which would have been attained under the previous tentative proposals, since the courses and periods of active practical experience are precisely the same as those which were foreshadowed under the scheme as first propounded, optional reversion to executive duties during the period of commander's service being the sole alteration to the original proposals. Employment in any specialist work should not prevent an officer from gaining the executive knowledge and habit of command necessary for the position of captain of a ship. Experience has shown up to the present that the time spent by an executive or marine officer in the Naval Ordnance or Naval Intelligence Departments of the Admiralty has not unfitted him for his executive or marine duties, and that the time spent by an engineer officer in an Admiralty or dockyard appointment has not rendered him incapable of performing his duties as an engineer afloat.

In the same way there is no reason why in future a short term of service at the marine headquarters, or at engineering work ashore or afloat, should incapacitate any officer, who is keen on rising in his profession, from the efficient performance of executive duties. But in order to obtain and maintain such complete interchangeability every facility for maintaining their executive efficiency will be given to specialist officers. Each specialist officer on board ship will be required occasionally to take duty on deck and in the engine-room whilst in the junior part of his service, and to perform the more responsible executive duties as his seniority increases.

Every specialist lieutenant must pass the prescribed executive examination for the rank of commander, or else forfeit his claims to any higher executive positions. Further, no officer will be permitted to embark on a specialist course of instruction until he has passed all the examinations for the rank of lieutenant and has served continuously as sub-lieutenant or lieutenant for at least a complete year at sea; he must also have obtained the necessary certificates of

competency in watch-keeping, etc., from his captain. It will probably be necessary to employ a proportion of specialist officers in their particular specialist work after they are promoted to the rank of commander, in order to obtain experienced officers for special positions. This employment will be regulated in the same way as the present appointments of commanders for navigating duties and of commanders filling special gunnery and torpedo appointments.

It is further probable that more officers will desire to continue specialist duties than will be required to fill the appointments in the higher ranks. The Admiralty will thus obtain the power of selection for particular specialist posts in each grade, and at the same time any officer who desires to revert to ordinary executive duties will be able to do so, subject to the sanction of the Admiralty. A proportion of officers will, no doubt, for various reasons, at some period relinquish hopes of filling the highest executive ranks and commands, and will prefer to continue in the specialist line for which their chief attainments may more particularly fit them.

DETAILED ARRANGEMENTS.

The following are the detailed arrangements for carrying out the new decision of the Board that there is to be no parmanent specialisation of engineer and marine officers: An officer entered under the new scheme who desires to specialise as a lieutenant for engineering, gunnery, marine duty, navigating, or torpedo, will be called upon to volunteer during the latter part of his service in the rank of sub-lieutenant at sea, and selections will be made annually from amongst those who are recommended. The officers who are selected for the various branches will then be withdrawn from sea service in time to begin the annual courses of instruction, but no officer will begin a specialist course until he is promoted to lieutenant.

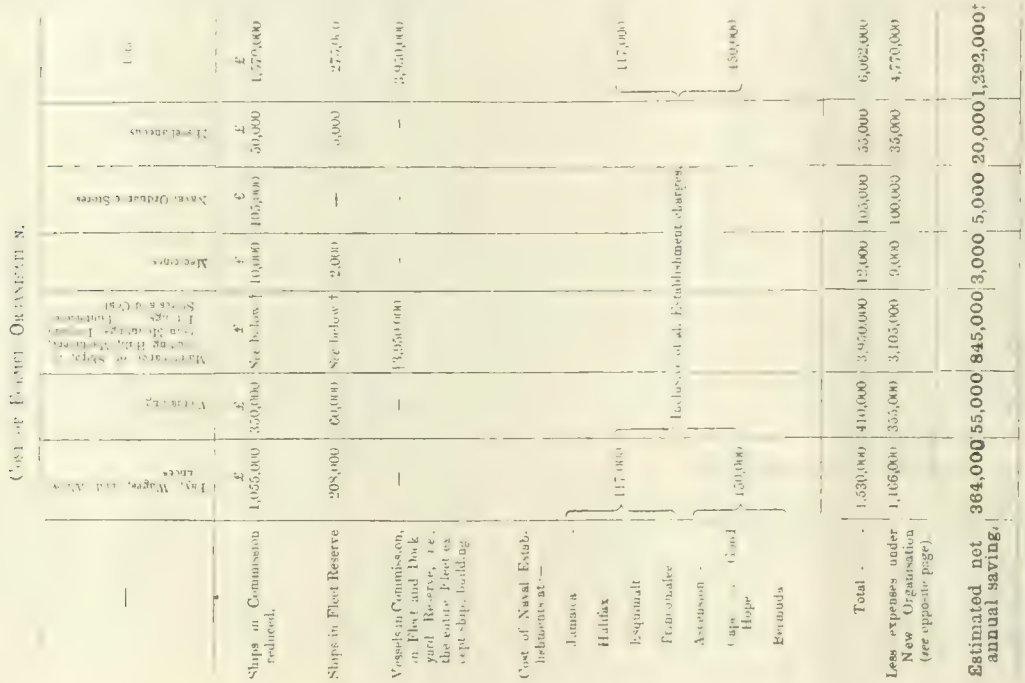
The special course of instruction to qualify as engineer officer will include practical and observational work at a dockyard, and also theoretical work and laboratory practice in testing and experimenting. No manual work will be included in this course, as the officers will all have a sufficient knowledge of practical workmanship. On completion of the course, and after qualification in the examinations, these officers will become lieutenants (E.), and will receive extra pay as such in the same manner as other specialist officers, and will be qualified to perform the duties of a junior engineer officer afloat. In the largest ships only three engineer officers will be required in addition to the warrant officer watch-keepers, viz., a commander (E.) or senior lieutenant (E.) as chief engineer, a lieutenant (E.) as senior engineer, and a junior lieutenant (E.) as Junior engineer.

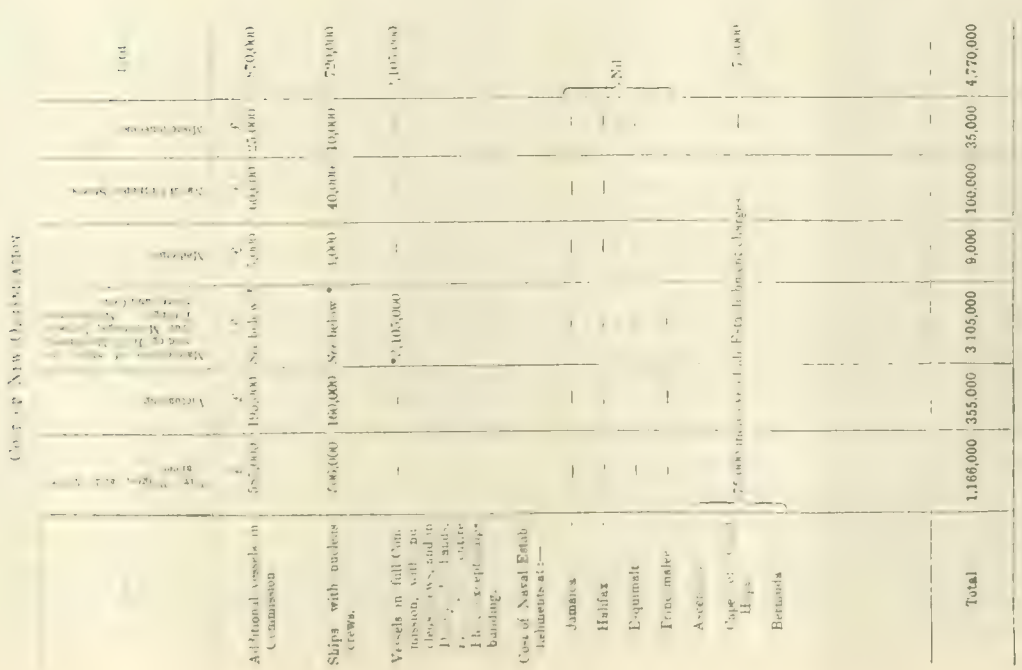
As regards the higher technical appointments at the Admiralty and dockyards, it is probable that a fair proportion of those officers who go through the (E.) course will be officers who have special aptitude and inclination for engineering work, and who will devote their lives to that particular branch of the Service, and that, consequently, many of them after passing the executive examination for commander, and so qualifying for the higher executive ranks, will forego the chance of executive commands afloat in favour of the important administrative positions in the Admiralty and at the dockyards which will be open to officers with high engineering qualifications. It is not possible at the present moment to lay down in detail what the course of instruction for these officers should be, since much depends on the results achieved during the period of qualification for lieutenant (E.), but it is considered that, after passing the examination for lieutenant (E.), a further course of about two years will be necessary to qualify officers for the higher engineering posts at the Admiralty and dockyards, subsequent periods of practical experience at sea being combined with service in the lower grades of these special appointments.

At the end of the course for lieutenant (E.), a certain number of officers will be selected to proceed to the further course for lieutenant (E.), and this course should immediately follow after the lieutenant (E.) course. In this way a practically continuous period of instruction will be secured. On the completion of the higher (E.) course these officers will be sent to sea-going ships for a period of at least one year, during which they will perform the duties of an engineer officer; they will then be available either to come on shore to a special appointment if their services are at once required, or to continue to perform the duties of an engineer officer at sea until they are needed to fill a special appointment. After a period of shore service these officers will again go to sea, in either an engineering or an executive capacity, as the Service may require.

One of the three avenues through which the Royal Corps of Naval Constructors is entered, viz., the Royal Naval Engineering College at Keyham, will shortly be closed. It is therefore necessary to widen the existing field of selection for members of this corps. This can best be done by including as candidates young men who have received a thorough grounding in mathematics, science, applied mechanics, etc., and the less advanced practical engineering work, but who may have had no opportunity of practical work at private shipbuilding yards. The restriction hitherto in force as to candidates having been through an apprenticeship in a shipbuilding yard will, therefore, be removed, and private students who enter at Greenwich for the course of training in naval architecture, preparatory to

...s members of the Royal Corps of Naval Constructors, will in future be required to pass an entrance examination in mathematical and mechanical subjects only, or to give evidence of ... qualifications, and to show a general acquaintance with practical engineering and mechanical subjects; the necessary shipbuilding and other practical work will be incorporated as a part of the Admiralty course of training. Under these conditions there should be no difficulty in procuring an ample supply of suitable candidates for the few vacancies that occur.





ESTIMATED FINANCIAL SAVING CONSEQUENT ON THE REORGANISATION OF THE FLEET.

MOTOR NOTES.

LACRE INDUSTRIAL VEHICLES.

PARTICULAR attention has been paid to the commercial side of motor engineering by the Lacre Motor Car Company, Ltd. A recent type of the production of the company in the heavy vehicle class is the 16-h.p. motor van, and we illustrate in this issue the engine which is fitted with this chassis.

The motor is of the two-cylinder vertical balanced type, having cylinders 4⅜-in. bore by 5-in. stroke, developing 16 b.h.p. The cylinders, main bearings, and crank pins are respectively lubricated by the patent mechanical pump lubricator, positively driven from the engine. Splash lubrication is only used for the minor bearings.

The inlet valves are mechanically operated, and by the loosening of a single nut both the exhaust valves or suction valves may be withdrawn. Relief cams are provided, which make the starting of the engine a simple and easy matter.

The motor is governed on the inlet by the Murray patent governor, previously described in this journal. It is sufficient to state, therefore, that at whatever speed the governor lever is set, the vehicle should maintain this speed up and down hill and on the level without any attention on the part of the driver, provided the hill is not too steep for the engine to take on that gear

The ignition is magneto-electric, the generator being mounted directly on the crank shaft. The armature and coils are stationary, and there are no sliding contacts, no commutators or brushes. The ignition system received a silver medal in the Automobile Club Thousand Miles Reliability Trials in September, 1903.

The correct instant for ignition for each speed of the engine has been carefully determined by experiment and a simple mechanism designed, controlled from the governor by the connecting rod, which automatically advances and retards the ignition.

SPECIALLY DESIGNED CARBURETTER.

The correct mixture of gas and air at various speeds and loads has also, it is stated, been experimentally determined, and from the data thus obtained the carburetter is designed with the object of giving the best mixture under all conditions, the opening of the extra air port being controlled for this purpose by the governor through the connecting rod.

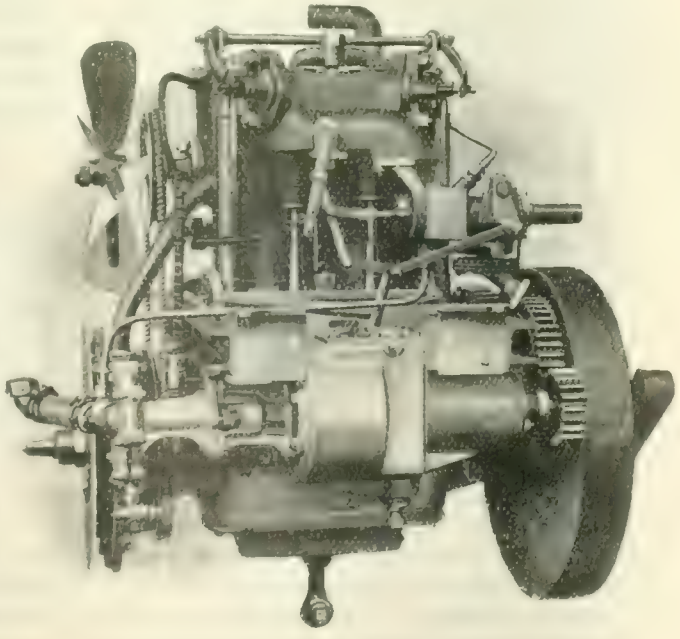
The tank carries six gallons of petrol, which is stated to be sufficient fuel for a distance of about 80 to 100 miles.

The friction clutch is of the usual leather-faced type of large dimensions. It is mounted on an extension of the engine shaft and exerts no end thrust while running.

NEW SPRING DRIVE.

The power is transmitted from the engine to the gear case through the improved form of spring drive, whereby the torque from the engine passes through a set of springs which absorbs any jerks or shocks due either to uneven roads or to careless manipulation of the fricton clutch. This assists the smooth running of the vehicle, and should reduce the wear and tear on the engine and gearing.

The speed-change gear provides three speeds forward and a reverse. The two higher speeds ahead are operated by positive clutches. The wheels for these run always in mesh, the top speed being a direct drive from the engine to the bevel gear. The changes

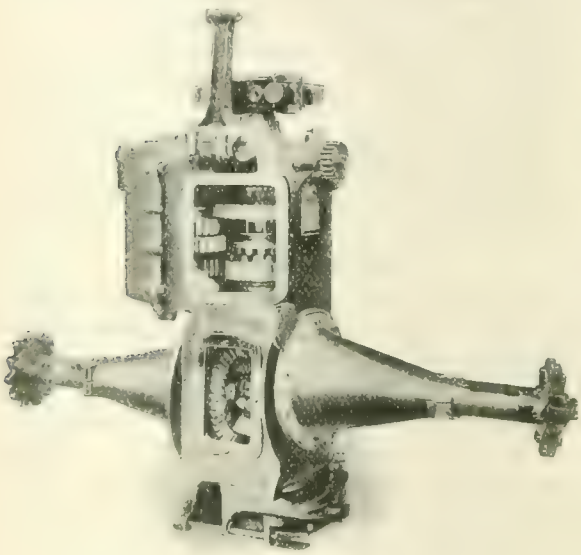


16-H.P. ENGINE AS FITTED TO LACRE MOTOR VAN.

of speed are all operated by a single lever, and the driver can pass direct from one speed to any other without passing through intermediate gears.

FEATURES OF CONSTRUCTION.

The chain wheels are not bolted to the spokes of the rear wheels, but mounted upon the hubs, which



LACRE GEAR BOX.

is preferable to the usual arrangement of side driving chains.

The cross-shafts are carried by a specially designed bracket, consisting of a steel tube inside a conical aluminium bracket, giving a light, rigid construction, and claimed to ensure correct alignment. In the

AUTOMATIC CARBURETTER.

heavy vehicles there is a swivel bearing provided to allow for unequal loading. The frame is of channel section steel, the side members being continued right forward to carry the front springs. All four wheels are 34 in. in diameter, of artillery pattern.

The wheel steering is of the irreversible type, with worm and segment working in an oil-tight case.

HIGH FREQUENCY CURRENTS.

In his second Cantor lecture on High Frequency Currents and Hertzian Wave Telegraphy at the Society of Arts last Monday, Prof. Fleming added an interesting chapter to the story. He pointed out the necessity in connection with wireless telegraphy to study in detail the phenomena of condenser discharge. Dr. Fleming has lately been considering a new method of representing and delineating an oscillatory spark. One of the points to be noted and it has an important bearing on wireless telegraphy—is the "decrement," which expresses the rate at which the oscillations in a circuit die away. For all practical purposes the oscillations may be considered to be concluded when the amplitude of the oscillations has fallen to 1 per cent. of the initial value. Another important factor is the damping factor—the ratio of the resistance to twice the inductance of the circuit. In an ordinary Marconi aerial oscillations are damped out so completely that, as is well known, they die away at about 20. Dr. Fleming and other investigators have used a hot wire ammeter for measuring currents and trains of oscillations whose mean square value ranges from ½ ampere up to 15 to 20 amperes. For measuring still smaller high frequency currents a satisfactory method has been designed by Duddell.

It is also very necessary, as Dr. Fleming points out, to investigate the spark voltage. When this final factor is ascertained it is then possible accurately to work out the details of the discharge of a condenser. Turning to the consideration of methods of determining decrement, it is necessary to distinguish between the radiation and the resistance decrement. In the case of wireless telegraphy the damping of the oscillations is primarily due to the radiation decrement. The subject of determining decrement has been studied by Rutherford and Bjerknes, and a method adopted by Drude capable of application to both open and closed circuits is based upon the use of a resonance curve. These researches have a direct bearing on the efficiency of a Marconi aerial. One problem in connection with the efficiency of a wireless telegraphy transmitter is to find an improved method of charging. Dr. Fleming is inclined to believe that the coil will be given up before long and superseded by some form of electrostatic instrument. At present there is a large waste of energy in the coil itself.

The directors of the Chicago, Milwaukee and St. Paul Railroad have formally authorised the extension of the line to the Pacific Ocean. The cost is estimated at £[illegible].

THE GRINDLEFORD STONE QUARRIES AND THEIR WORKING.

By Benjamin L. Bradley.

THE Grindleford Stone Quarries are owned by the Derwent Valley Water Board, and are worked for the supply of stone for the construction of the dams of the Derwent Valley water scheme, which will ultimately cost from six to seven millions. The object of the scheme is the increased supply of water to Nottingham, Sheffield, Derby, and Leicester. The site of the quarries at Grindleford is 10 miles from the site of the dams, and about 12 miles from Sheffield. The site is most compact owing to the rock face being continuous in length for about 1,200 yards. The average depth of rock is 65 ft., and the stone is very close to the moorland surface.

The surface of the top working faces is approximately 1,000 ft. above sea level, and about 600 ft. above the Dore and Chinley line of the Midland Railway.

The quarries have an output of about 6,000 tons weekly, and a sufficient length of face is cleared for an output of 7,000 tons weekly, should it be required. The only work connected with the quarries, which is let by contract, is that of dressing the face stones. The remainder of the work at the quarries is carried out by administration.

The area of the quarry with access roads, accommodation works, railways and stone area is 52 acres. It is approximately estimated that there are 2,400,000 tons of good building stone on the site.

ACCESS TO QUARRIES.

The Midland Railway Company with 3½ miles of line connect the quarries with the Water Board's private railway. For their own accommodation they have, outside the Board's boundary, constructed special sidings for the Board's traffic, two roads being laid to the boundary to connect with the quarry railways. From the boundary the Board have constructed a double line of railway on the flat, connecting with a double line incline cableway having a gradient of 1 in 3. The incline is 750 ft. long.

RAILWAYS.

The railway from the incline summit runs zigzag with gradients of 1 in 25 to the top quarry faces. From the main line, branches lead to each working-face. Turnouts are laid from each branch. The branches are used as stand-bys for the wagons whilst being loaded, the cranes doing their work on the branch turnout. Branches from the main line are also laid for stocking full and empty trucks. Both the main line and the truck branch railways on the middle and top lifts are laid with down gradients from the north to the south end of the quarries.

The whole of the branch truck roads junction with the full stock roads; the full trucks being shunted into the stock roads by gravitation. The shunting by gravitation saves the cost and maintenance of a locomotive. The gradients on the bottom lift are in the opposite direction, and meet the main line. The empties are sorted by gravitation, but are pushed into the different quarries by locomotives.

Flat-bottomed 65 lb. rails are used for laying the tracks of the main line and truck branches. Sleepers 9 ft. by 9 in. by 4½ in. are used for the branches. These are uncreosoted to enable the men to handle them quicker than if they were creosoted. Dog-spikes are used to fasten the rails to the sleepers; twelve sleepers are laid to every 30 ft. length of track. The turnouts on which the travelling cranes run, are laid with 65 lb. rails for the tracks on which the 7 and 8-ton lifting cranes travel, and 85 lb. double bull-headed rails with chairs for the track on which the 12-ton lifting cranes travel. For this track the sleepers are 15 ft. by 12 in. by 6 in. and have 2 ft. centres. Owing to the quick curves (200 to 500 ft. radius) oak cleats, shaped to fit against the web of the rail and having a full bearing, are spiked to the sleepers. The crossings from main line to branches are not of a quicker spread than 1 in 5; owing to this the branch roads and turnouts are slewed several times to follow up the working faces, before the positions of the crossings need altering.

MACHINERY AND PLANT.

Four locomotives and twelve steam travelling cranes are employed in the quarries. The cranes are used for filling the baring debris into wagons, pulling rock out of quarry faces, turning stones for scabblers and masons and for general loading. Two cranes travelling on broad gauge (11 ft.) are built to lift 12 tons at 17 ft. 6 in. radius of jib, nine to lift 7 tons at 16 ft. radius, and one

... 30 ft. to 32 ft. radius. The cranes are all supplied with coil for raising and lowering jib, slewing and traversing. Duplicate sets of machinery and winding gear are kept in stock in case of a breakdown.

Four locomotives are employed, one with a 14 in., two with 12 in., and one with a 10 in. cylinder. The 10 in. engine feeds and withdraws the traffic on the incline at the foot; one 12 in. engine does the same work at the summit. The 14 in. engine works the main line and shunts the bottom lift quarries. The 10 in. engine pushes the empty trucks into the working-places at the upper lifts, and also runs tip wagons to spoil bank.

The external parts of the whole of the machinery and plant used on or about the quarries are examined twice daily, and a written report is made as to their condition. The drivers are not allowed to start a machine in the morning, unless a form which is hung on each machine is signed by the foreman fitter on the last inspection of the previous day.

THE CABLEWAY.

In working the cable-way, the full wagons from both incline roads are delivered to one road only of the Midland railway sidings, one road of incline acting as a through road to the railway for full wagons, whilst the full wagons on the other incline-road are run on to a cross-over and through a slip on to the access road which is linked up to the Midland full wagon road. The empties are supplied direct from the Midland sidings through a cross-over to one incline road. For the purposes of safety in case of runaways, a refuge is provided. In order to provide against fogs an automatic signalling apparatus is employed, treadles being laid inside the outer rails of the incline at three different points. These treadles are connected to alarm bells, which indicate the position of the wagons on the ... to the brakesmen in the cabin at the summit ... to the attendants at the foot of the cable-way.

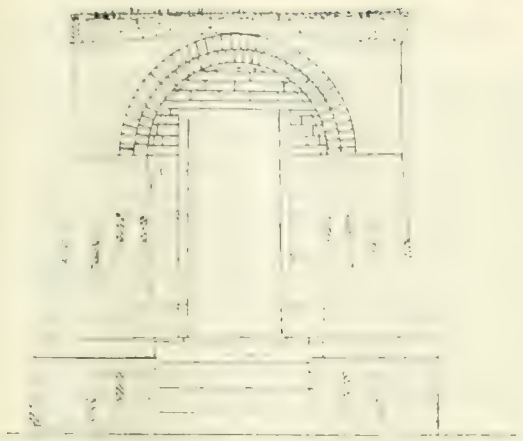
HAULAGE

Haulage on the incline is effected by gravitation, the weight of the loaded trucks drawing up the empties. A self-acting winding drum is employed. The pedestals of the main shaft rest on stone piers. The drum is 15 ft. diameter and 7 ft. wide. ... of the drum are constructed of steel plates ½ in. thick, having an overall diameter of 16 ft. 6 in., with cast-iron centre and oak laggings 4½ in. thick. The main shaft is 8 in. diameter overall and turned all over; this works on cast-iron pedestals with gun-metal bearings.

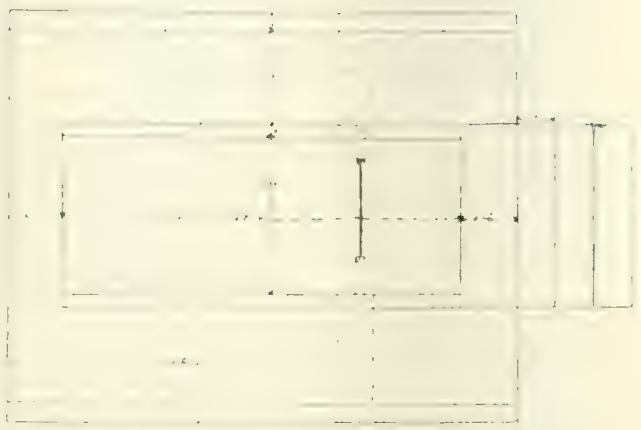
On each side of the drum there is a 9-in. brake ring, composed of radial casting, which are bolted to the side plates. Brake bands are made of the best ½-in. Low Moor iron; the width of each band is 7 in. The bands are fastened to iron discs, 3 ft. diameter, with stretching screws. The discs are keyed on to a 4-in. diameter steel spindle; the spindle works on three cast-iron pedestals, with gun-metal bearings. Two pedestals are fixed in the wall boxes of the right-hand pier, one being flush with the outer side of pier. The spindle passes through these two pedestals, and projects on the outside sufficiently to have a brake operating lever keyed on. On the other end of lever a rod is attached; the rod runs in pulleys ... below ground into the brakesman's cabin, the cabin being 150 ft. from the drum. The brake is manipulated by a hand-wheel working on a pinion. Bearing rollers are fixed to timbers placed underneath the brakestraps to take the weight of the strap when the brake is off.

Running through the laggings of the drum and shackled to the frame are two 1½-in. diameter wire hauling ropes with hemp core. The breaking strain of the ropes is 80 tons. A safety cable is spliced on to

DETAILS OF CONSTRUCTION OF TIP WAGONS USED IN THE GRINDLEFORD STONE QUARRIES.
The capacity of each wagon is 5 yards of excavated earth.



FRONT VIEW OF MAGAZINE.



PLAN OF MAGAZINE.

The sides battered and plumb end-walls are of rock-faced stone built in cement mortar, and are 2 feet thick at springing of arch. The roof is arched with two rings of bricks in cement mortar.

the main cable. The safety cable is drawn underneath the frame of the railway wagon and hooked on to the opposite draw bar. As a test 130 full trucks have been run over the cableway (the 130 fulls drawing up 130 empties) in ten hours=4·6 minutes per truck. This time includes placing by locomotives the loaded trucks on summit, coupling and uncoupling, and withdrawing trucks and replacing at summit and foot of incline. The average number dispatched daily is 120 fulls, receiving 120 empties.

The writer has made tests of the advantage in weight required by the descending load to draw over the summit the ascending load, and in several tests (different trucks being used each time) an advantage of three tons will draw the ascending load over the summit; the trucks as soon as they arrive top and bottom come to rest without the use of the brake. These tests are only mentioned to give a rough idea and cannot be taken as a basis for calculation as in some cases more or less friction may take place owing to the inflexibility of the straps, as even when the brake is off, there is always a certain amount of friction on the brake race. There is never a greater direct load than ten tons on each cable. This gives a factor of safety of eight on each cable.

WORKING ARRANGEMENTS.

Owing to depth of face which averages 65 ft. and also to the change of level of the underside of the rock from north to south, the quarries are worked in three lifts. The low lift is south, the middle lift mid north and south, and lower beds of rock at north end. The baring of about 280 yards in length, and rock getting at north end are worked from the top lift.

The rock being heavily fissured vertically, a great quantity of stone is got in suitable sized blocks by driving wedges horizontally, these blocks being gauged as near as possible from 20 to 30 tons each. The process of getting these blocks is as follows. First, a chase or groove is cut by the bottomer pick, and this forms a race in which to fix the wedges ready for driving with the 18-lb. hammers. After a cleavage has been made by the cutting wedges—should the cleavage have taken an upward course from face to back of block—a groove is cut sufficiently large at the back of the block to admit a canting hook or stone dog, and to the hook a length of wire rope is attached with an eye, which is spliced on to the opposite end of the rope to the hook. The eye is hooked on to the crane winding rope, the crane either by winding or travelling pulls the block to rest at the foot of the face. To save the stone from damage by the fall, the cranes travel elevated 10 to 12 ft. above the underside of the rock, the elevated ground being tipped debris and sand from baring and fissures.

If the stone dips in a downward direction from the face to back the blocks are lifted at the back, heavy lifting levers being used; at the same time the crane is assisting in the same manner as described with blocks with upward cleavage, packings being placed under the back edge. Cases often occur when the cleavage is

horizontal [illegible] nearly so [illegible] free back being a considerable distance from the face. When this occurs the stone is lifted sufficiently high to admit iron balls being rolled underneath, and the block rolled off its bearings.

DISPLACING LARGE BLOCKS IN BULK.

When a block of 100 to 400 tons has to be displaced in bulk owing to its dangerous position for men to work, screw jacks worked by long levers are brought into use. Grooves are hewn at the back of the block, sufficiently deep to admit the jacks horizontally; the block is then pushed off its bearing and is cut to suitable sizes at the foot of the face. When a dangerously-placed block has a downward natural cleavage from back to face, the foot is blown out and the released block usually falls without the aid of levers and cranes.

After the blocks are at rest at the foot of the face, the rough ends are knocked off; and if the stone is sound and free from flaw, it is placed by the crane on to what is termed the banker, which is a piece of ground at each working face, reserved for the purpose, and usually adjoining the truck road on the outer side.

When on the banker a man with a rock pick and kevel squares the joints and beds at right angles to the face, picking the surface as fine as possible, so that the mason has not a quantity of projecting stone to knock off with the punch. The mason then chisels a draft at the face on joints and beds, also knocks off any knots, left by the scappler, to a true surface. The scappler and mason usually work in pairs and for the work are paid 9s. per superficial yard, face measurement. Any stones measuring over 3 ft. 6 in. to 5 ft. long from face to back of stone are paid for at the rate of one and a half times face measurement.

Blocks which are not free from flaws, but are hard, have one side roughed over with the pick, and are sent to the dams to be used as displacers or plums to be placed in the concrete. Owing to the fissures in the body of the rock, and to the stones having a good natural shape, very little work is required on the displacers. Stones having less contents than 12 cubic feet are broken into suitable pieces for stones crusher and used in the concrete.

In addition to the small blocks a large quantity of rubble in small pieces is taken from the rock faces, and only requires a small proportion of breaking ready for crushers. Taking the stone in bulk, the best pieces are cut from the largest blocks as these are more free from "dries," *i.e.*, close natural cleavages.

The following is the tonnage of the various classes of stone sent to the site of the dams from June 13th, [illegible] to the end of September, 1905. The stone averages 14 cubic feet to a ton. Rubble, 108,540 tons; displacers, 133,751 tons; and dressed 32,200 tons.

A supply of [illegible] gallons of water per day of ten hours is required for machinery and workshops. The nearest source of supply is a stream in a ravine 360 ft. below the top working faces of the quarry. A hydraulic ram to lift 16,000 gallons in twenty-four hours to a height of 350 ft. is fixed close to the stream. The water is pumped to a height of 370 ft. into tanks which together hold 35,000 gallons. From these tanks the water is distributed to tanks of less capacity, fixed at different parts of the quarry. The machinery at the working faces is supplied from stand pipes branched from the main

In order that work in the faces may not be interfered with through leakages or other defects in the pipe supply tanks on wagon wheels are kept filled, and are taken by locomotives to the place where the supply from the pipes is cut off, acting as a temporary supply until the main supply is reinstated. This method is also adopted when branches require lengthening to follow the faces. The supply pipe from the main tanks is 2½ in. diameter; the branches are 1½, 1, and ¾ in. diameter.

BLASTING AND RESULTS OF SHOTS.

In the Grindleford quarries explosives are chiefly used for displacing the keys or wedges of curled stone which hold tight the great blocks in the main body of rock, also for stone which is too soft for building purposes; likewise for useless beds of surface rock, and for blowing out the bottoms or feet of large blocks with downward sloping backs to the faces of the rock.

Power drills are not used for boring, as there is not sufficient blasting to pay the costs of removal and maintenance. Hammer drills and jumpers, forged from the best Sheffield drill steel, are therefore used. Owing to the wear or reduction in width of drill, the diameter of the bore of the open end varies as the depth. A bore, 8 ft. deep, with a diameter of 2 in. at the bottom, is started at 4 in. diameter on the face. The reduction in width of drill averages ¾ in. per foot length of bore. The cost of drilling averages one shilling per foot of bore.

Opinions differ as to the method which should be adopted for fixing a base of calculation for charge of explosive. It is the author's opinion, confirmed by practical experiment, that either the squares or cubes in feet of length of line of least resistance should be taken for fixing a base for the calculation. Text-books and formulæ are sometimes useful as rough guides in fixing the quantity of each charge, but the formulæ in text books should not be taken as being anything near exact in fixing a calculation for quantity. For instance, a tough millstone grit require a greater charge of explosive for displacement than a harder but more

brittle granite, both having the same line of least resist-

RESULTS OF EXPERIMENTS WITH EXPLOSIVES.

To get the best results from explosives, experiments should not be made haphazard and hurriedly. Blocks on which gradual experiments are to be made should also be carefully examined to see if they are solid, and they should be as nearly as possible of the same quality and substance throughout.

The author holds that experiments should be made by taking both the squares and cubes in feet of the line of least resistance to fix a base for calculating the weights or quantities of charges; the experimental charges being first made in small quantities, then gradually increased until the required effect is obtained. To find whether squares or cubes should be taken for fixing a base, both should have the same line of least resistance commencing at 2 ft. and increasing to 6 ft. These experiments would afford sufficient data on which to base the quantities of the charges.

When the experiments are complete and a base fixed, the man who makes up the charges and fires the shots should have instructions as to the quantity of explosive required per foot line of least resistance, that term at the same time being explained to him. This is very necessary as, although some of these men have made up charges and fired shots for years, they have not the least notion of what is meant by the line of least resistance. On the other hand they erroneously gauge their quantities on the depth of bore and no regard is paid to the excessive charges and serious waste of explosive. As a rule, the powderman is only happy when the explosions create noises like peals of thunder.

At the Grindleford quarries gelignite and large grain powder are the explosives used. From experiments made by the author with gelignite in heavy sandstone grit, when blasting the rock keys and curled stone which were wedged in on all sides except the top bed and face having also a greater width on back than on face, he found that the charges gave the best results when the squares in feet of line of least resistance were proportionate, the charge for 2 ft. being 4¼ ounces.

Or assuming the line of least resistance to be 6 ft:—

	Square of 2 ft. Line of least resistance.	Charge in gelig nite in oz.		Square of 6 ft.	Charge required.
Then as	4	: 4¼	:	36	38¼ oz.

When the blocks were free to vent for explosion on all sides, substituting two ounces for 4¼—

	Square of 2 ft. Line of least resistance.	Charge in gelig nite in oz.		Square of 6 ft.	Charge required.
Then as	4	: 2	::	36	= 18 oz.

Owing to the action of gelignite striking in several directions the explosions not only displaced the rock at the line of least resistance but also slightly shattered the main body in close proximity to the bore.

Where sound blocks require displacing, powder is the explosive used. It was found by experiment that with powder, the squares of lines of least resistance gave the best results of charges. When the block was wedged as described in the gelignite experiments and having vent only at the narrow end and top bed, the best effects were obtained when the charge for a 2 ft. line of least resistance was 12 oz., or assuming 6 ft. to be the line of least resistance—

	Square of 2 ft. Line of least resistance.	Charge in oz. gelig nite in oz.		Square of 6 ft.	Charge required.
Then as	4	: 12	::	36	= 108 oz.

When the blocks were free and having vent to explosion on all sides, again assuming 6 ft. to be line of least resistance and substituting 7 for 12—

	Square of 2 ft. Line of least resistance.	Charge in gelig nite in oz.		Square of 6 ft.	Charge required.
Then as	4	: 7	::	36	= 63 oz.

In no case did the line of least resistance exceed two-thirds the length of the bore.

Blasting has been in operation at these quarries nearly three years, and the calculations for charges are based on the first experiments and in nearly all cases the desired results have been obtained. The tamping in the bore holes is made with shale rammed tight, only wooden stemmers being used for ramming. Double tape safety fuse is used for firing the shots, the fuse burning at 1½ minute per foot. Should a charge miss fire (which rarely occurs), no one is allowed to go near it for thirty minutes; the shot-firer immediately giving warning of the miss-fire. Whilst the charges are being exploded a bell is continuously rung until the explosions have been completed. In the event of a miss-fire no attempt whatever should be made to extract a charge; but after half-an-hour, another hole should be bored a few inches from the first and to the same depth, and in such a manner as not to give the first charge a chance of shock or ignition. The firing of the second charge will explode that in the first bore.

COST OF WORKS AND OUTPUT.

The following costs relate to two periods. First, from the commencement of quarrying, June 13th, 1903, to December 31st, 1904; and second, from January 1st to June 15th, 1905.

CABLEWAY

	s.	d.	
[illegible], pumping, hauling and tipping in stiff [illegible]	2	11½	per cub. yd.
[illegible] rock	4	0½	"
[illegible]	0	8	per sup. yd.
[illegible] drains (including land tiles and [illegible] rubble)	0	9	per lin. yd.
Laying track, single road (including crossings), [illegible]	2	6	"

RAILWAY

Excavating loose rock, hauling and tipping	1	3	per cub. yd.
[illegible]	0	1	per sq. yd.
Laying track, single road	1	0	per lin. yd.

COSTS ON QUARRYING OPERATIONS.

	[illegible] to December 31, 1904		January 1 to June 15, 1905	
	Tons	Cost	Tons	Cost
		d.		d.
Baring and moving debris	277,933	4·317	85,000	4·156
[illegible]	187,933	14·0	99,070	8·0172
Breaking and loading [illegible]	89,916	11·39	57,502	15·3459
Dressing, turning and loading displacers or plums	78,776	21·0	33,346	10·4111
Dressing, turning and loading face work	19,841	90·179	8,043	94·8836
Cableway maintenance and [illegible]	—	5·122	—	2·7540
Railway maintenance and [illegible]	—	6·534	—	2·1999
[illegible] cost of land	156,176	2·713	99,070	0·5197
Proportionate cost of cableway construction	—	0·909	—	0·3422
Proportionate cost of railway construction	—	0·675	—	0·2551
Proportionate cost of railway construction (main [illegible])	—	0·261	—	0·0983

The cost of the various classes of stone despatched from the quarry delivered at the bottom of the cableway on to the sidings of the [illegible] Railway, for the above periods, is as follows :—

	[illegible] to June 15, 1905.		June 13, 1903, to December 31, 1904	
	Per Ton.	Per cub. yd.	Per ton.	Per cub. yd.
	d.	d.	d.	d.
Rubble	34·0483	59·5841	45·927	80·372
Displacers or plums	29·1135	50·9486	5[illegible]·557	97·190
Dressed [illegible] work	113·5860	198·7[illegible]	124·716	218·253
The [illegible] all classes is about	40·0282	70·0492	57·649	100·887

[illegible] charged against the output account for the various classes of plant are as follows, viz. :— Locomotives, cranes, winding drum, tip wagons, rails, crossings, switches, fish plates, and chairs, 10 per cent. on original cost. Hydraulic ram, 7½ per cent. on original cost. Sleepers and crossing timbers, 20 per cent. on original cost.

[illegible] paper read before the Society of Engineers.

KING'S COLLEGE ENGINEERING SOCIETY.

The annual dinner of this society was held at the Hotel Cecil on November 25th. Professor A. K. Huntington presided, and among those present were Sir A. Rücker (Principal of London University), Sir A. Binnie (president of the Institution of Civil Engineers), Mr. C. H. Wardingham (Chief Electrical Engineer to the Admiralty), Professor J. J. Thomson, Professor D. S. Capper, and Professor E. Wilson.

Sir A. Binnie, responding to the toast of the "guests," said he was gratified to find himself among students [illegible] in which he studied 47 years ago. The most important piece of advice he could give them was not to specialise, but to study every branch of science that might serve them in their profession, for the duties of an engineer were widely varied and might seem incongruous. In the Indian Works Department some years ago his duties ranged from the construction of a gallows to the discovery of coal and the carrying out of large waterworks. In this country the profession was overstocked, and it would be well for young engineers to obtain experience in distant lands upon which to build self-reliance.

Professor Capper, replying for "The College and Staff," referred with pride to the fact that King's College had taken the first engineering science degree in the University of London. He felt most strongly that in the development of the University the collegiate spirit engendered by the traditions of King's College would have a powerful influence.

The Chairman, in proposing "The Society," said that the result of the so-called "sandwich" system of education—the alternation of works with the college course—had been distinctly encouraging.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

The first general meeting of the session of the North-East Coast Institution of Engineers and Shipbuilders was held in the lecture hall of the Literary and Philosophical, Newcastle, Lord Armstrong, the president, in the chair.

The report of the 21st session showed a total membership of 1,083, made up as follows :—Hon. members, 5; life members, 7; members, 837; life associates, 3; associates, 125; and graduates, 106. During the year the Institute lost by resignations and other causes 66 members, 13 associates, and 14 graduates, and added 27 members, 3 associates and 22 graduates. The sum of £48 6s has been written off as irrecoverable arrears of subscriptions, in addition to which £96 12s. stood on the books as arrears. The income from subscriptions amounted to [illegible]. The Institution had [illegible] invested. The report was adopted. A paper was read by Mr. C. Schofield on the subject of pneumatic tools as applied to ship construction, and their advantages to shipbuilders and engineers. In this, the speaker explained the methods adopted in American shipyards as to the application of pneumatic tools in ship construction, also the cost of the same, and made a comparison with the British piece-work hand rates.

SIR WILLIAM PREECE ON THE SOUTH AFRICAN VISIT OF THE BRITISH ASSOCIATION.

Sir William Preece lectured before the Society of Arts last week on the recent visit of the British Association to South Africa, and contributed an interesting [illegible] learned. Running through the descriptive portion of the lecture, came Sir William's own shrewd comments. Naturally the reference to the first-class technical institute established at Johannesburg [illegible] on which to hang some opinions on the perennial topic of technical education. The tendency of all education in the part at home has been, thinks Sir William Preece, to instil "culture" into the minds of the young; now the tendency is to encourage "action." The one is purely mental; the other is mental and physical. Hence in all systems of higher education, technical matters are much to the front. Technical education means training the mind so that it may assist the hand. The craftsman, if he have scientific method of thought, knows the reason why of every motion and the use of every tool. The engineer understands not only the mode of producing energy by chemical operations, but he designs the applications of this energy to innumerable useful purposes by utilising air, water, steam, gas, or electricity. We have great object-lessons in America and Germany in proving to us the value of encouraging technical attainments, and it is a matter of great satisfaction to find much progress at home and certainly considerable activity in South Africa which cannot fail to be [illegible] of the British Association.

THE GOLD INDUSTRY.

No account of the British Association's visit would be complete without reference to the mining industry, and naturally a large share of attention is devoted to the gold industry. Sir William comments on the mechanical refraction which takes place in boring operations, remarking that it is now quite certain that many turf boreholes have given false measurements as to the depth at which different reefs have been struck. This deviation is of little consequence when the boring operations are properly surveyed and the curvature measured, as they can be, during the course of boring. Moreover, it can be checked by temperature observations. The rise of temperature has been found in the Rand to be 1 deg. per 208 ft. by Mr. Hugh Marriott, who has designed a mode of determining the deviation of a bore. Mr. Payne-Gallwey has also designed a very beautiful machine, and Mr. Hatch has worked at the same problem.

DIAMONDS.

The Premier Mine, where the great Cullinan diamond was found, is referred to in some detail. Up to the time of the visit of the Association 2,051,964 loads of ground had been treated. They yielded 1,511,931¼ carats of diamonds, or 0·736 carat per load. The total weight of diamonds obtained was 6 cwts. 19 lb. One carat, is of course, equal to 3·17 grains, and a load equals 1,600 lb.

Sir William Preece, witnessed the sorting and valuation of 70,000 carats of diamonds whose value was estimated at £90,000. South Africa is the largest diamond producer in the world; Brazil comes a poor second, and the third place is taken by Borneo and India About £6,500,0000 worth of diamonds are extracted annually from the mines in South Africa.

The Transvaal Government claims 60 per cent. of the allotted area as the property of the Government, leaving 40 per cent. to the owner or company working the mine. Thus the Government obtains, as taxation or revenue, 60 per cent. of the profits of the mine. It is a large proportion. The Orange River Company exact 50 per cent., but the Cape Colony have no such provision. The Kimberley mines pay only income tax.

OTHER MINING PRODUCTS.

[illegible] mining resources outside gold and diamonds copper is abundant, especially in Rhodesia, as well as lead, plumbago (graphite), zinc, antimony, tin, quicksilver. [illegible] been discovered and is now being vigorously exploited in the Bushveldt, not far from Pretoria.

Iron is also abundant but it has not yet been worked. If manganese were found there, then with an inexhaustible supply of iron and coal, the introduction of the Bessemer steel process into South Africa would make a serious onslaught upon the American and British steel industry, and react with great force on all other local industries in that country.

There is some prospect of oil being found, for shale is abundant. Petroleum has been found at Ceres (Cape Colony), but no prospecting has yet taken place.

Sir William Preece sums the effect of the South African visit up by the statement that the results to those who went with the British Association had been educative, and he hoped they had been beneficial and stimulative to the colonial hosts.

No. 3 HIGH POWER RAPID REDUCTION LATHE, 19-in. CAPACITY.

BY THE SPRINGFIELD MACHINE TOOL COMPANY.

THE accompanying illustration shows a high-power rapid reduction lathe built by the Springfield Machine Tool Company, having a capacity sufficient to swing a piece 19 in. in diameter in the rough. This lathe was designed with a view of obtaining the full capacity of modern high-speed steels, with a sufficient number of spindle spools in geometrical progression to meet all practical purposes.

The headstock is of massive proportions, with ample driving power for the spindle from a 4½ in. belt over a 12 in. single face pulley running direct upon the spindle at moderate speed.

Twenty speeds are obtainiable with a two-speed countershaft of simple form, as follows: First, two direct belt speeds obtainable by a positive clutch operated by handle A connecting pulley to spindle; second, six speeds are obtained when lever A is in the position as shown in cut, with lever B connecting the face gear C to the spiral gear D by positive clutch. Gear D being driven by its mating pinion keyed fast to the shaft E in the rear. This shaft having three gears, F, G, H, mounted loosely upon it, any one of which may be connected to same by an internal positive clutch operated by handles, and driven by one of the three gears, I, J, K, which are keyed fast to the pulley. Twelve more spindle speeds are obtainable through the double back gears, which are placed in front of the spindle in the following manner: The face gear C is disconnected from spiral gear D, allowing D to revolve freely upon the spindle. The spiral gear D has keyed to it two gears, L and M, either one of which may engage back gears N or O, and driving spindle through pinion P, and face gear C. It is impossible to injure gears N, O, as they are positively locked in one or the other driving position by a hook upon lever Q, which also affords means for sliding gears from one position to the other; this lever receiving its locking and unlocking motion from handle R, which has an eccentric projection extending through the housing into which the back gear-shaft is mounted with an eccentric bush at the other end.

By this system of gearing it will be seen that two direct belt speeds are furnished for finishing cuts, and six more through the spiral gearing, which produce a smooth motion, making eight finishing speeds in all. The remaining twelve geared speeds are for roughing and heavy cuts upon large diameters.

The speeds are arranged to produce a constant cutting speed for diameters from 1½ in. to 18 in. The disposition of the back gearing in front of spindle relieves the caps of any strain, thus increasing its rigidity.

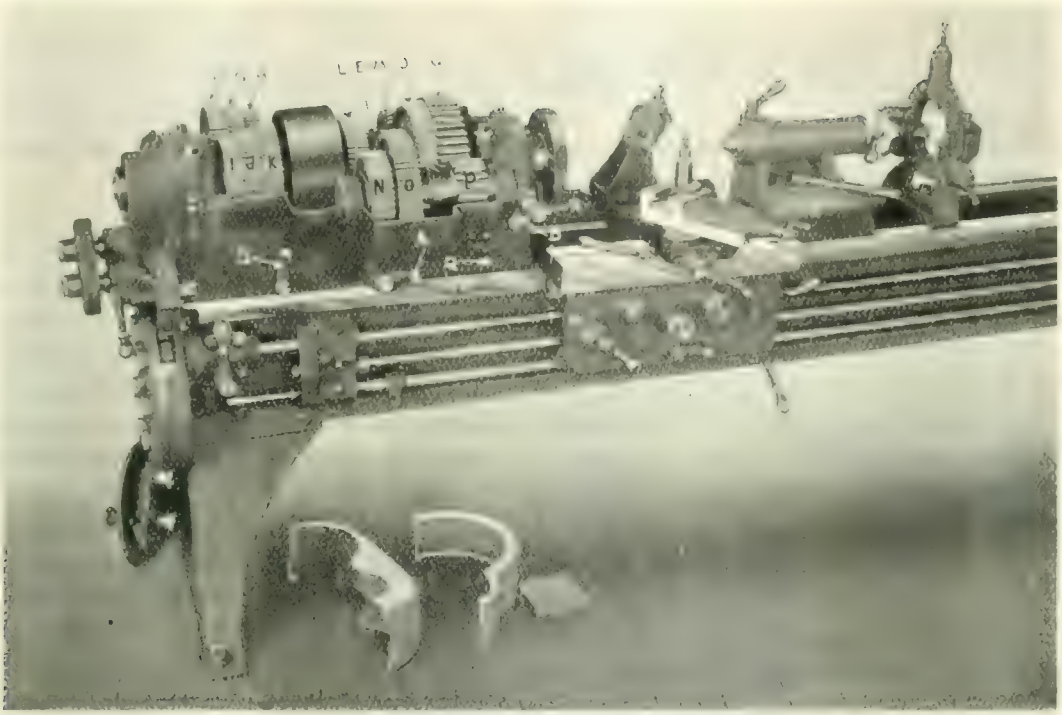
The spindle is made of crucible steel with a 1 $\frac{31}{16}$ in hole its entire length, ground perfectly cylindrical running in self-oiling bearings of an efficient type. The thrust collars are steel hardened and ground. Centre corresponds to a No. 5 Morse taper.

The entire mechanism is covered with neatly designed guards, which may be lifted off for inspection and oiling.

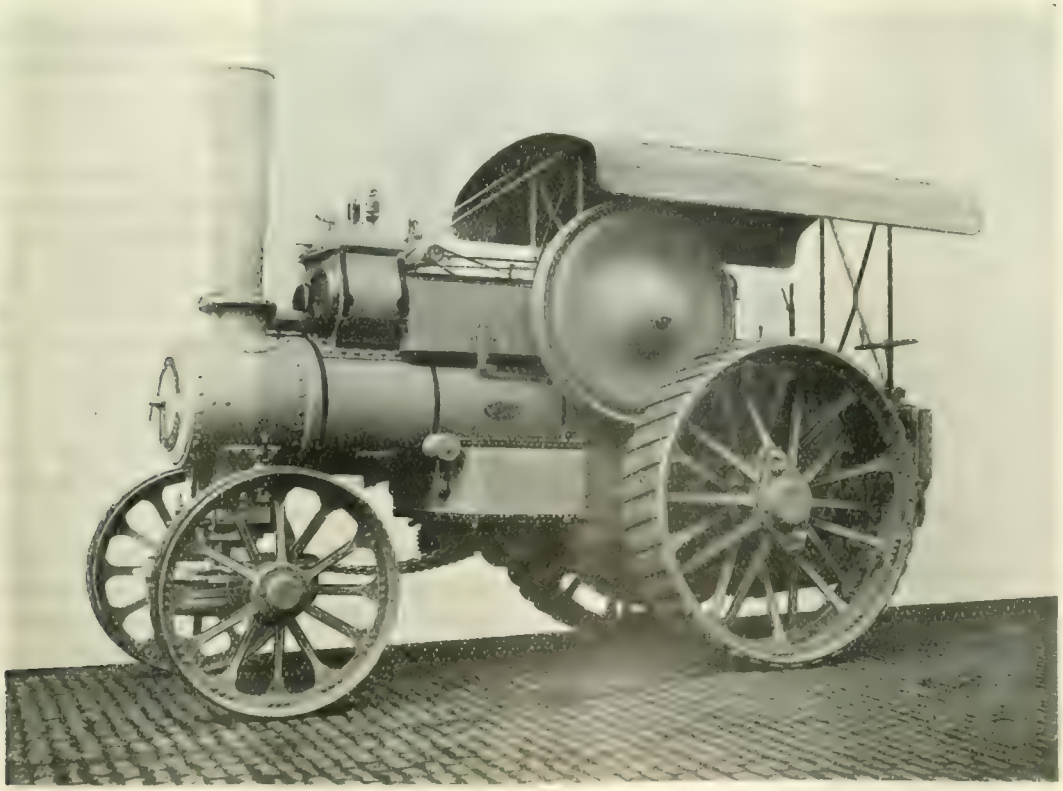
The tailstock is of specially heavy pattern, with a large spindle fitted with a No. 5 Morse taper centre. The spindle is clamped by two bushes eliminating any tendency to throw same out of line. The carriage has long bearings, one V and one flat; cross movement is by power. The crossfeed screw has micrometer collar reading to 1,000th of an inch.

The lathe is equipped with the rapid change gear mechanism furnished on all "Ideal" lathes. The machine may, however, be equipped instead with a positive gear-feed, giving six variations of feed and regular change-gears.

The countershaft has one tight pulley and two friction pulleys of an improved form. The following are some of the principal dimensions: front bearing of spindle, 3¾ in. diameter by 7 in. long; back bearing of spindle, 3¾ in. diameter by 5¼ in. long; hole through spindle 1 $\frac{5}{16}$ in.; diameter of pulley, 12 in.; width of belt, 4½ in.; ratio of back bearing, 4 and 8 to 1; diameter of tailstock spindle, 2 $\frac{11}{16}$ in.; cut screws from 1–38; feeds from 5–140; actual swing of bed, 19¾ in.; actual swing over carriage, 12 in.; speed of countershaft, 150 and 130 revolutions per minute



NO. 3 HIGH POWER RAPID REDUCTION LATHE, 19-IN. CAPACITY.



DOUBLE CRANK COMPOUND SPRING MOUNTED ROAD LOCOMOTIVE BY JOHN FOWLER AND CO. (LEEDS), LTD.

(See p. 1253.)

OUR WEEKLY BIOGRAPHY.

SIR ALEXANDER BLACKIE WILLIAM KENNEDY, LL.D., F.R.S., M.Inst.C.E.

Emeritus Professor of Engineering at University College.

CLOSELY connected with the development of electrical engineering in this country is the name of Sir Alexander B. W. Kennedy. Born at Stepney in 1847, he received his preliminary education at the City of London School, and from there proceeded to the Royal School of Mines. Upon the completion of his scholastic training he was apprenticed to Messrs. J. and W. Dudgeon, marine engineers and shipbuilders, with whom he remained until his twenty-first year, when he joined the staff of Messrs. Palmers, of Jarrow, as a leading draughtsman in their engineering works. In 1871 he went as chief draughtsman to Messrs. T. M. Tennant and Co., Ltd., of Leith. A year later he associated himself in business with the late Mr. H. O. Bennett as consulting engineers, in Edinburgh. In 1874, after having engaged in technical journalism, he was appointed to the chair of engineering at University College, London.

SIR A. B. W. KENNEDY, LL.D., F.R.S., M.INST.C.E.

In 1877 Professor Kennedy was responsible for designing and establishing at his college the first University engineering laboratory in the kingdom. This scheme was described in a paper he contributed to the transactions of the Institution of Civil Engineers, for which he was awarded a Telford medal. The growth of his private practice as a consulting engineer, in 1889, rendered necessary his retirement from academic life; then it was that the Council of University College conferred on him the title of Emeritus Professor of Engineering.

For many years he carried into practice the experimental work he had developed in the engineering laboratory. He was also occupied in making experiments in elasticity and strength of materials, tests of engines and boilers, and he was also responsible for the design of the steel structural work which form the skeletons of the Alhambra Theatre and Hotel Cecil. Among the most important items in his experimental work were the Society of Arts' engine trials of 1888–9, which he conducted with the late Dr. John Hopkinson, and the late Mr. Beauchamp Tower. Professor Kennedy drew up the report, which was published by the Society of Arts, and was subsequently awarded a gold medal for his paper on the subject.

Professor Kennedy was chairman of the Marine Engine Research Committee, and strongly emphasised the necessity of carrying out complete engine and boiler trials at sea, separating the boiler results from those of the engines. In spite of great opposition at the time, he eventually succeeded in obtaining permission to carry out such trials on six steamers, for which he devised the necessary apparatus. The results were published in the Proceedings of the Mechanical Engineers for 1889-92, and, as is generally known, this method of making trials has been adopted by the Royal Navy and the Boiler Committee of the Admiralty.

Professor Kennedy was president of the Institution of Mechanical Engineers in 1894–5, and has also been made an Honorary Life Member of it. He was elected a Member of the Institution of Civil Engineers in 1879, became a Member of the Council in 1893, and is now the senior Vice-President. He was elected a Fellow of the Royal Society in 1887, and served on the Council in 1895–6. He is also a Member of the Institution of Naval Architects, the Institution of Electrical Engineers, and the Physical Society of London. In 1893 he gave a Friday evening discourse before the Royal Institute on "Possible and impossible economies in the utilisation of energy."

Since 1890 Dr. Kennedy has schemed the whole system and works of the Westminster Electric Supply Corporation, and from the outset has been their chief engineer. He has designed and carried out electric lighting and power stations in Glasgow, Edinburgh, Aberdeen, Sunderland, Carlisle, Chester, York, West Hartlepool, Grimsby, Kirkcaldy, Rotherham, Darlington, Croydon, and Manchester, and numerous other places, including in many cases the execution of tramway or light railway schemes.

In 1899 he was consulted by the London County Council as to the electrical working of their system of tramways, and it will be remembered that he reported finally in favour of a conduit system for all the central parts of the town, with overhead connections through outlying suburbs. After much discussion, his report was adopted, and he was instructed to prepare a scheme in accordance with it. This met with the approval of the Board of Trade, and after being embodied in the usual specifications, was used in the construction of the South London (Tooting) Tramways.

On the death of Mr. Greathead, he became joint engineer with Mr. W. R. Galbraith for the Waterloo and City Railway. He schemed the whole of the electric part of this work, which was carried out to his specifications. As consulting electrical engineers to the Great Western Railway his firm has prepared the plans for the work of electrification now being carried out west of Paddington on the Great Western and Hammersmith and City Railways.

In 1900 he was appointed by Lord Goschen a member of the Belleville Boiler Committee, and in conjunction with the other members of the committee carried out the trials on the *Hyacinth* and *Minerva*, which were published in the committee's first report, and which finally settled the question of the Belleville boiler. The committee have since carried out similar trials on a number of other vessels. Their final report was made in 1904, and immediately after its presentation, Sir Alexander was appointed President of the permanent "Machinery Design Committee" at the Admiralty, constituted at the instance of Lord Selborne, and now appearing in the Navy List beside the older Ordnance Committee.

Sir Alexander Kennedy takes an enthusiastic interest in mountaineering; he is an expert photographer, and, as he remarked a few days ago at an anniversary meeting of the Royal Society of Musicians, ever since his childhood he has been able "to express his emotions in the gentle and humane art of music."

THE RESULTS OF TECHNICAL EDUCATION IN ENGINEERING.

By JOHN GOODMAN, M.Inst.C.E.

(*Continued from page 1220.*)

TECHNICAL education is largely responsible for the improved position that engineering now occupies. For a long time it was regarded as a mere mercantile pursuit; then science was brought to bear upon the work of the engineer, and engineering now occupies the position of a learned profession whose exacting demands are fully recognised.

It has enabled gigantic engineering schemes to be successfully carried through which would have been quite impossible under the old rule of thumb regime. As a notable example, we may cite the Forth Bridge.

Technical education has done much towards reducing the cost of production. The cost of designing is less because the design is arrived at by a direct process which is necessarily quicker than the old trial and error method. The cost of material is less, because more suitable materials are now procurable (thanks to the scientific metallurgists), and because there is less waste, the exact amount required in each case being arrived at by calculation. The cost of manufacture is reduced, due to improved lifting appliances, to better machine tools, and to high speed steel, all of which owe their existence directly or indirectly to technical knowledge.

Technical education enables the designer to turn out novel and improved designs. Some branches of technical education, of little value in themselves, are invaluable as aids to training the imagination—the very root of novelty in design.

It has the effect of rapidly developing and maturing inventions, a point sometimes of the highest importance, not only to the trade and profession of engineering but also to the country itself. If a comparison be drawn between the development of the reciprocating steam engine and that of the steam turbine we find that for nearly two centuries the steam engine made practically no progress in the hands of men who had no pretence to a knowledge of science, whereas it progressed by leaps and bounds under the scientific treatment of Watt, Hirn, and others, who were pioneers in the application of thermo-dynamics to the steam engine. In the case of the steam turbine, however, [illegible] quarter of a century has elapsed since that highly scientific and brilliant engineer, Mr. Parsons, invented a practical form of this machine, and to-day we have it as near perfect as it is ever likely to be. We think we are justified in expressing this opinion, since the steam consumption of a turbine closely approaches the minimum possible in a theoretically perfect steam engine. Even the most bigoted of practical men will not pretend for one moment that the enormous difficulties encountered in the development of the steam turbine could ever have been surmounted without the aid of science, and we may go so far as to say that no firm can even follow in Mr. Parsons' footsteps and manufacture a satisfactory turbine to-day without the aid of scientific men in the form of draughtsmen or managers.

To take another instance—the development of the internal combustion engine, which many farseeing men believe will in the near future supplant the steam engine. Its birth as a practical machine is well within the memory of many of us, although many experimenters, groping in the dark, had previously dabbled with it; the problem was not solved until a highly-trained doctor of philosophy in Germany took the matter in hand and from a noisy, troublesome, uncertain toy produced one of the most useful and efficient heat motors known. But great as was Dr. Otto's work, still greater perhaps was that of Diesel, who, from a purely theoretical standpoint attached afresh the problem of the internal combustion engine and at one sweep nearly doubled its heat efficiency, or in other words nearly halved its consumption of fuel.

Many other instances of the triumph of the scientific treatment of engineering problems might be cited, but there is one branch that stands out pre-eminently where science, and science only, deserves the credit—viz., electrical engineering—a branch that lends itself so readily to theoretical treatment; and where there are so few disturbing elements that one can foretell results with almost the same degree of certainty as in astronomy, yet it is a branch of engineering that is full of mysteries and difficulties to the untrained man, and not a single electrical invention of any importance has ever emanated from an untechnical man.

Technically trained men supply us with exact data. Nearly every up-to-date engineering firm employ highly trained technical men in its testing departments Here the machines or engines are thoroughly tested before leaving the works, thus yielding exact data

output the steam consumption the friction and other losses and the general efficiency and practicability of their products—knowledge that is of the greatest value in subsequent designing.

The value put on experimental work by the largest engineering firm in this country—Messrs. Armstrong, Whitworth and Co.—may be judged from the recent utterance of Sir Andrew Noble: "A very costly source of expenditure was experiment; they lived by experiment; they could do nothing if they did not constantly and continually experiment." But what, may we ask, is the use of experiment without the aid of highly trained technical men to interpret the results obtained therefrom?

HOW TECHNICAL EDUCATION HAS BENEFITED THE COUNTRY AT LARGE.

As a result of our giving a thorough technical training to the men who are to design and carry out engineering work, considerable benefits accrue not only to engineering firms, but also to the country at large. We may enumerate these benefits as follows:

(1) Increasing facilities for travel and transportation.

(2) Cheapening of both the necessities and luxuries of life which would otherwise be both costly and irregular in supply.

(3) Increased power of production.

(4) Enhanced prestige and trade.

Technical education in the strict sense of the term is not however the panacea for all our trade troubles; another equally important matter is the business education and training of the commercial heads of our manufacturing concerns.

HOW TECHNICAL EDUCATION WILL RESULT IN THE FUTURE.

Vast sums of money are being spent on the technical education of engineers at the present time, but whether such money is being wisely expended is open to discussion. Technical instruction is required for two distinct classes of men. The one class is the rank and file from which draughtsmen, managers and foremen are drawn; these should have a good grounding in the first principles of mathematics, mechanics, heat, chemistry, metallurgy, and electricity, yet their work does not call for a very extended knowledge of any one of these subjects. The other class is that of specialists who are required to give much time to the higher and more difficult problems of engineering and to devote a large portion of their lives to research work—privately or for firms. It is necessary for such men to go deeply and thoroughly into whatever branch they may take up; they require the general training we have outlined above as a foundation after obtaining which they should proceed with their own specialised studies. Every engineering college in the country can give the general training, but as a rule the heads of engineering departments are, or ought to be, too fully occupied with lecturing and with the general work of the department to devote the necessary time to the higher work required by the special students. Moreover, no one man can possibly have such a thorough knowledge of several special branches of engineering as to be able to give the necessary instruction in more than one or two subjects, hence we would urge that each engineering college, in addition to its general course, should lay itself out for specialising in one or two particular branches. At present, more or less of this special work is done in the final year of the general course of instruction which is attended by all classes of students, with the result that some have to spend much of their time on branches of work that they are not interested in, while they do not get the instruction they are eager for in their own particular branch.

In one respect it is believed that much public money is being wasted in educating multitudes of evening students to a very low standard—far too low to allow of them making any use whatever of their smattering of science. We are fully aware that some work of this kind is necessary in order to discover latent ability and to act the part of a sieve, but we would urge that when the sifting process is complete, those who have not been retained by the sieve should be discouraged from further pursuing such studies and should be advised to take up some other branch of work in which they may subsequently show up to advantage. The indiscriminate technical education of the masses to a low standard is, we believe, useless, and is indeed a waste of time and energy which would be far better expended upon those who show distinct signs of ability and who should be encouraged in every possible way to attain to the highest pitch of perfection as specialists.

From a paper read before the Manchester Association of Engineers.

The Russian Government have just completed a reinforced concrete bridge over the river Kazarguene at the village of that name on the road from Verder to Revel. It consists of thirteen arch spans, each of 75·5 ft. opening, resting upon twelve masonry piers of granite and one of ordinary concrete, the facings of the two abutments being of granite. The width of the bridge is 23 ft., including a paved roadway of 17·5 ft., and two sidewalks of 2·75 ft. each. The total length of the bridge is 985 ft., and exactly 977 ft. between the abutments.

TESTS OF THE FLOATING DRY DOCK "DEWEY."

By Civil Engineer A. C. Cunningham, U.S. Navy.

In the early part of June, 1905, the Maryland Steel Company reported the self-docking steel floating dry dock, since named the Dewey, ready for test, having completed the same in one month's less time than the twenty-seven allowed by the contract.

The increased confidence in this class of dock for warships, and in the Dewey dock in particular, is shown in the fact that one of the latest and heaviest ships, the armoured cruiser *Colorado*, was selected for the preliminary test.

Before docking the *Colorado*, the dock was sunk to 29 ft. draught over the keel blocks and then pumped up light to a freeboard of 2½ ft. The sinking was accomplished in one hour and thirty-six minutes and the pumping up in one hour and two minutes, showing that the dock is of very rapid action. On this test it was also demonstrated that little or no trimming was required, the dock sinking and rising practically level with all valves open.

The *Colorado* was docked on June 23rd last, having a displacement of 13,300 tons at that time. The main and docking keel blocks were all set at the same height. In this preliminary test no effort was made to secure speed, and one half-hour was used in making flushing and fire connections. The elapsed time from when the ship landed on the blocks until the keel came out of water was two hours and sixteen minutes. Pumping was continued until the dock had a uniform freeboard of 2½ ft., only enough excess of water being retained in the side walls and end compartments to give the necessary trim. The *Colorado* was carried on the dock about twenty-four hours without changing the water ballast. When the dock had reached a freeboard of 2½ ft. with the *Colorado*, the deflection on the main keel line in the 500 ft. of length of the dock was about ¼ in.; after about twenty-four hours the deflection in 500 ft. increased to about 1 1/16th in. After undocking the vessel, the dock was found to have practically straightened without retaining any set.

After the undocking of the *Colorado*, deflection observations were continued for three days, and variations in deflections with the dock unloaded due to temperature changes of ⅞ in. were noted.

The battleship *Iowa* was docked on June 27th, for a record test, having a displacement of 11,600 tons at the time, and was carried on the dock for forty-eight hours. The specifications required that a 16,000 ton ship should be raised in four hours from the time the ship took the blocks until the keel was out of water. For the equivalent of a 16,000 ton ship the dock was pumped to a freeboard of 4½ ft. From the time the *Iowa* took the blocks until the keel was out of water was one hour and thirty-seven minutes; to the time the dock had a freeboard of 4½ ft., two hours and forty-two minutes. During the docking of the *Iowa* one of the three pumping engines was out of commission for forty-two minutes with a slipped eccentric, so that the actual time of the operation of the dock is about half that allowed by the specification.

The *Iowa* was docked by uniform pumping, as in the case of the *Colorado*, and carried for forty-eight hours without change of water ballast in the dock. The specification required that when a ship had been docked by uniform pumping until the dock had a freeboard

of 2 ft. the deflection in the entire 500 ft. of length of the dock should not exceed 3 in. When the dock reached a freeboard of 4½ ft. with the *Iowa*, the deflection was about 2 in. During the first twenty-four hours, the dock remaining uniformly pumped, the deflection increased to 4 in. in the 500 ft., and during the second twenty-four hours showed a recovery to 3⅜ in.

Immediately following the undocking of the *Iowa* the dock was pumped up to the same depth of water in the compartments as when the ship was docked, which gave a freeboard of 9 ft. 6 in., and it was found that the dock had a hog of 1 in. During the night this hog disappeared, and early the next morning was a half-inch sag. The greatest deflection in the bearing length of the *Iowa* while carried on the dock was about 1¾ in. The deflection observations indicate that there was no permanent set caused by the docking, and that temperature variations may cause considerable hog or sag

After the undocking of the *Colorado* the main and docking keel blocks were found to be uniformly indented about 1/16 in. with no crushing. No change was made in the blocks for the *Iowa*, and after undocking she was found to have rested even more easily than the *Colorado*.

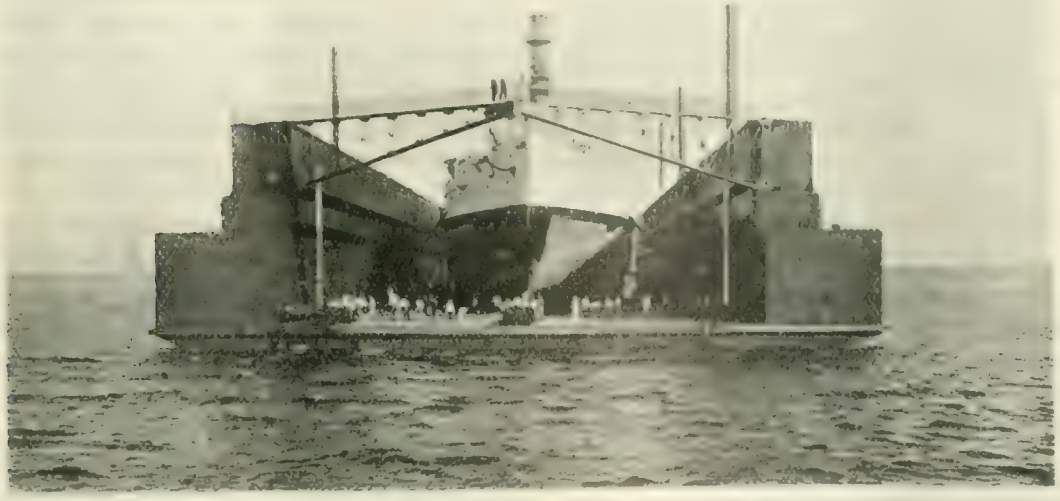
With 2 ft. of freeboard and 1 ft. of water remaining in the pontoons the carrying capacity of the dock is 18,500 tons, and a 20,000-ton ship could readily be docked with sufficient freeboard to admit of easily working on its bottom.

The results of the tests with the Dewey dock show that it is considerably in excess of the contract requirements in strength, time of operation, and capacity. The dock was constructed under the supervision of Civil Engineer Leonard M. Cox, U.S. Navy, and was tested by a board of naval officers.

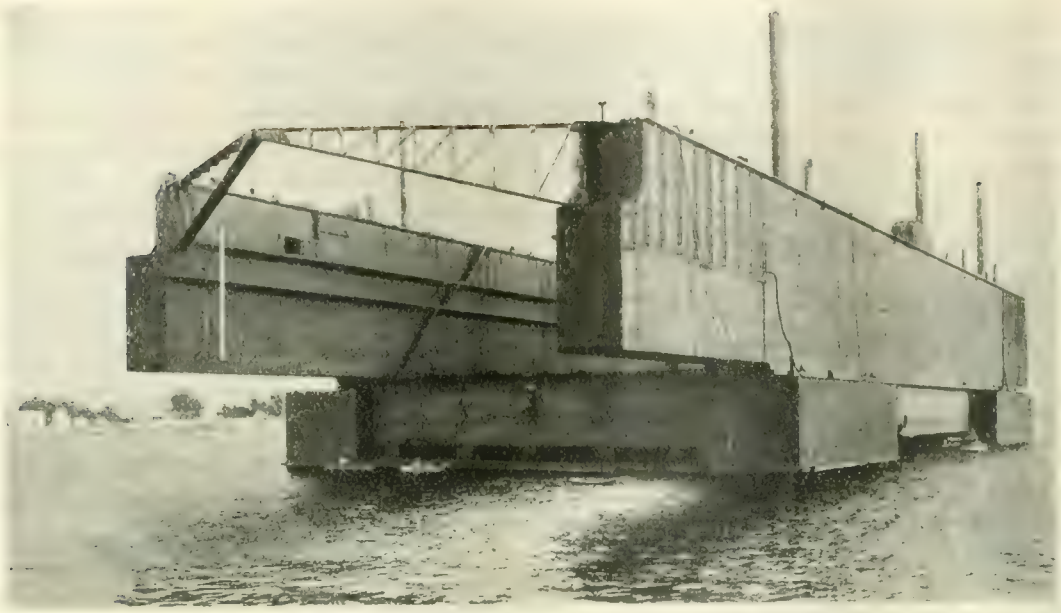
CHIEF CHARACTERISTICS OF THE DOCK.

The report on these tests by Civil Engineer Leonard M. Cox includes the following :—

The dock is built in three sections. The centre section, or pontoon, is 316 ft. in length with side walls overhanging 80 ft. on either end. Two end pontoons each 90 ft. in length, with low independent side walls are attached to the centre pontoon in such a way that the



THE FLOATING DRY DOCK "DEWEY," U.S. BATTLESHIP "IOWA" COMPLETELY DOCKED.



CENTRE PONTOON SELF-DOCKED ON END PONTOONS.

overhanging side walls of the latter are enclosed between the independent walls of the end pontoons and rest directly on their decks when the sections are connected for docking ships. There are vertical and horizontal connections between the pontoons, the vertical connections consisting of seven elements, each made up of 44-2 in. bolts; the horizontal of four elements, one along each edge of the overhanging side walls, each made up of 96-1½ in. bolts. The lower ends of the vertical connections are out of water at light draught.

SELF DOCKING.

Self-docking is accomplished in two stages. After removing the connection bolts the end pontoons are hauled clear of the overhanging walls of the centre pontoon, turned so that the direction of their lengths is perpendicular to the axis of the dock and brought over the deck of the centre pontoon and centred on blocking, as in the docking of ships. The centre pontoon is then pumped to the desired freeboard by the main pumping engines. The second stage of the operation has for its object the lifting of the centre pontoon. The end pontoons are submerged to a depth giving 12 in. clearance between the blocks and the bottom of the centre pontoon at light draught, and are then drawn under either end and centred, after which they are pumped to the desired freeboard by means of a separate pumping plant installed in the independent side walls, to which steam is furnished by a flexible hose led from the forward and after boilers.

The total working time consumed in the self-docking tests, exclusive of the time spent on the blocks, was about 15 days, but it would seem probable that the time could easily be reduced to ten or eleven working days.

The Cavite dock has so far proved a complete success, and the self-docking features are particularly satisfactory. In the light of experience with other self-docking types, it would seem that, as regards the saving effected in time and labour, facility of control and simplicity of operation, the self-docking problem has been satisfactorily solved and the greatest objection to the floating dock *per se* completely eliminated.

Abstract from the Journal of the United States Naval Institute

STANDARD LOCOMOTIVES FOR INDIAN RAILWAYS.

THE second issue of the report of the Locomotive Committee on Standard Locomotives for Indian Railways has just been issued by the Engineering Standards Committee. Since the first issue of the report standard engines have been actually built, and in the light of the experience obtained from them, certain revisions have been found necessary in the report. The present issue embodies the necessary alterations.

The five designs of locomotives which accompany the report, especially as regards the 5 ft. 6 in. gauge, only provide for passenger and goods engines and tenders of the type which it is thought will prove most universally useful at the present time on the majority of Indian railways; but the committee wish it to be understood that they consider that other types for heavy passenger and goods work, and for ghats and shunting purposes, will have to be designed on the same lines to fulfil the requirements of the various railways in India as they may arise.

5 FT. 6 IN. GAUGE.

Taking first the proposed passenger engine and tender for the 5 ft. 6 in. gauge, the boiler has been designed for a working pressure of 180 lb. per square inch, and with as large a heating surface and grate area as it was found possible to obtain without exceeding the admissable weight.

The "Belpaire" system of fire-box has been adopted, as it gives more steam and water capacity than the usual arrangement with semi-circular outside shell and girder stays for the inside fire-box, and with increasing pressure and larger fire-boxes the length and weight of girders become excessive, and direct staying has to be resorted to. Most of the new engines recently designed for English railways are now fitted with "Belpaire" boxes, as well as the new engines of the Bengal Nagpur Railway, Great Indian Peninsula Railway, Madras Railway, etc.

The inside cylinder type of engine was decided on as being that almost universally adopted for the 5 ft. 6 in. gauge lines in India. It was decided to recommend the use of a balanced slide valve and the "Stephenson" link motion, so that the use of rocking shafts became practically inevitable. It may be mentioned that the latest mail engines for the Indian State Railways (North Western Railway) have this type of cylinder, valve, and motion. They have been running for some time, and are reported to give every satisfaction. It was decided to keep the frames straight throughout, and not to set or splice them at the front end to give clearance for the side-play of the hind bogie wheels. This necessitated a somewhat narrower fire-box than would otherwise have been obtainable.

The wheel diameters were fixed with the view of using tyres identical with those of the largest number of engines of this type existing in India; certain details, such as the type of brake, smoke-box, and the style and position of the reversing gear, not being essential parts of the design, were left to be settled as may be found desirable in each particular case.

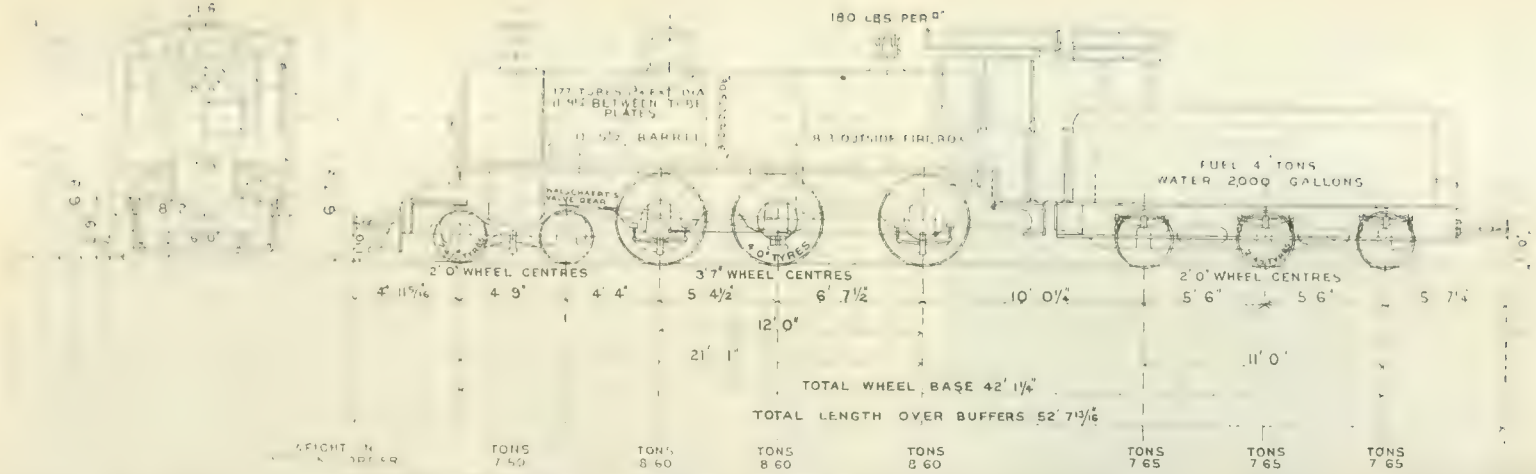
Taking next the goods engine for 5 ft. 6 in. gauge lines, as arranged by the conference, the boiler, cylinders, valve motion, axles, axle-boxes, horn-blocks, etc., are as far as possible identical with corresponding parts of the passenger engine design, while the wheel diameter has been fixed to enable the tyres to duplicate with those of the largest number of engines of this type existing in India.

METRE GAUGE.

The passenger engines for metre gauge lines and the mixed traffic, or goods engine, have been designed largely on the same lines as the engines recently adopted on the Bengal and North Western and the Rohilkund and Kumaon Railways; and it will be seen that, by the adoption of a bogie in front it has been possible to obtain a very much larger boiler and fire box than was admissable in the F Class engines, the weight of which was limited by their having only three axles, while the types now proposed have five axles.

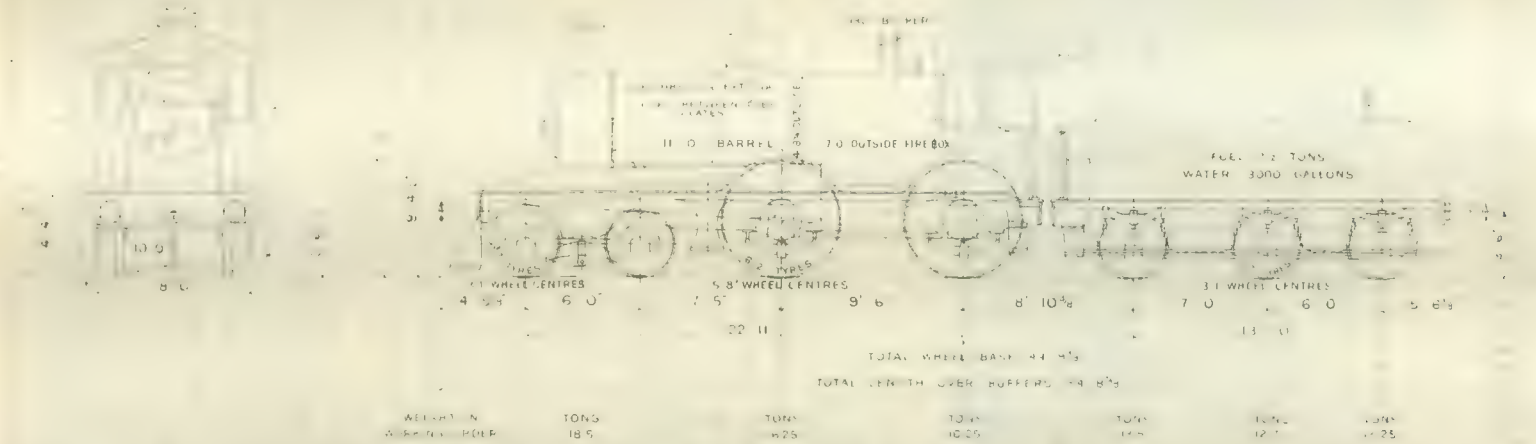
For metre gauge lines which have outgrown the O and F class engines, it is thought that the designs of passenger and mixed traffic or goods engines will fulfil their present requirements, as engines of similar design to the latter are being regularly used on the Bengal and North Western Railway, hauling, it is reported, heavy loads, with success. For metre gauge lines having heavy gradients and heavy traffic a powerful eight-wheel coupled "Mastodon" type heavy goods engine has been designed.

In these engines the "Belpaire" system of fire-box has been adopted for the same reason as in the case of the 5 ft. 6 in. gauge engines.



MIXED TRAFFIC OR GOODS STANDARD ENGINE AND TENDER FOR METRE GAUGE.

Weight in working order—engine, 33·30 tons ; tender, 22·05 tons ; total weight of engine and tender, 56·25 tons Gauge, metre ; cylinder dia., 15 in. by 22 in. ; coupled wheels dia , 4 ft. ; boiler, 180 lb. per square in. ; heating surface—tubes, 654 square ft. ; firebox, 108 square ft. ; total, 1,062 square ft. , grate area 16 square ft. , weight on coupled wheels, 25·80 tons ; tractive force—13,022 lb at 75 per cent. boiler pressure ; 10,706 lb at 90 per cent. boiler pressure . adhesive weight divided by tractive force (factor of adhesion) 4·15 and 3·46.



PASSENGER STANDARD ENGINE AND TENDER FOR 5 FT. 6 IN. GAUGE.

Weight in working order—engine, 51·0 tons ; tender, 30·5 tons ; total weight of engine and tender, 90·5 tons ; gauge, 5 ft. 6 in. ; cylinder, 18½ in. by 26 in. ; coupled wheels dia , 6 ft. 2 in. ; boiler, 180 lb. per square in. , heating surface—tubes, 1220·5 square ft. ; firebox, 120·0 square ft ; total, 1349·5 square ft. ; grate area, 25·3 square ft. , weight on coupled wheels, 32·5 tons ; tractive force, 16,233 lb. at 75 per cent. boiler pressure, 19,480 lb. at 90 per cent. boiler pressure . adhesive weight divided by tractive force (factor of adhesion), 4·48 and 3·73.

In all the types of [illegible] engines the [illegible] valve motion has been adopted as well as inside frames in which it is easily examined and oiled, and it permits the use of the balanced slide valve.

The Committee have not overlooked the preference expressed by the Calcutta Conference for engines having frames outside their wheels, but it should be remembered that when this opinion was expressed no metre gauge engine with frames inside the wheels of modern design was running in India. The difficulties anticipated in the oiling and examination of the inside frames engines have not been found to exist in the new engines sent to the Bengal and North Western, and Rohilkund and Kumaon Railways, and the width of the fire-box is only 2 in. less than in the outside frame engine. On the other hand, the advantage gained in reduction of the width between the cylinders, the elimination of the fly crank from engines of high power, the more effective staying of the frames and reduction of weight in all parts except the boiler, which can thus be made more powerful, are of such importance that the committee, after full consideration, have adopted the inside frame, which, it may be observed, is very largely used on narrow gauge lines in other countries than India.

Instructions to designers and findings of the Conference of Consulting Engineers and Locomotive Builders as to the component parts of the standard locomotives for Indian railways, having been approved by the Committee, are appended to the report.

The Committee has received the greatest assistance from the manufacturers of Indian locomotives, who are naturally interested in retaining the construction of locomotives for India in this country, and it is hoped that the labours of the Committee may materially help to bring about so desirable an object.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The annual report for presentation at the New York meeting of the above society states that during the year the council has held six meetings. Various gifts are acknowledged. From Mr. E. R. Archer, of Tredegar Iron Works, of Richmond, Va., was received a piece of armour plate cut from the turret of the monitor *Montauk*, one of the monitors built from the designs of John Ericsson during the Civil War in 1862. An indentation made by the shot of the Confederate gun shows that at that time there were no guns sufficiently powerful to penetrate this armour plate, but with the modern guns of to-day the shot would have passed through as easily as if made of tissue paper. It is interesting to know that this monitor was struck ninety-five times in the various actions in which she was engaged without serious damage during the Civil War, at Charleston and elsewhere. From the Institution of Mechanical Engineers of Great Britain has been received a handsome illuminated address expressing from that body their thanks and recognition for the courtesies enjoyed at the hands of the society during the successful joint meeting of the two societies in [illegible].

The society has been asked to co-operate in the commemoration of the one hundredth anniversary of the first successful trip of Fulton's *Clermont* on the waters surrounding New York, and also in commemoration of the two hundredth anniversary of the birth of Benjamin Franklin. Messrs. George W. Melville and Chas. H. Loring have been appointed to sit in conference in relation to the Fulton celebration, and Mr. H. H. Suplee in connection with the Franklin Institute celebration.

The committee entrusted with providing and operating headquarters for the society in the machinery building of the St. Louis Purchase Exposition, reported the consummation of their duties with the close of the exposition and their opinion that while perhaps the maintenance of such headquarters at former expositions might have been worth while, it was their opinion from the conditions at St. Louis that it would not be advisable to repeat the experiment at subsequent expositions.

The council has approved the by-laws submitted to it for its comment from the trustees of United Engineering Society, which is the corporation created under the laws of the State of New York to hold and administer the building, the gift of Mr. Carnegie for the uses of the engineering societies and the profession.

The spring meeting of 1906 is to be held at the city of Chattanooga, Tenn.

The following papers, for presentation at the New York meeting, have been received: "Reinforced Concrete Applied to Modern Shop Construction," by E. N. Hunting (Pittsburg); "The Realisation of Ideals in Industrial Engineering," by H. F. J. Porter (New York); "Results of the Preliminary Producer Gas Tests of the U.S. Geological Survey Coal Testing Plant at St. Louis," by R. H. Fernald (St. Louis); "Natural Gas Under Steam Boilers," by J. M. Whitham (Philadelphia); "On the Measurement of Air Flowing into the Atmosphere through Circular Orifices in Thin Plates and under Small Differences of Pressure," by R. J. Durley (Montreal); "Tests of Elevator Plant in the Trinity Building, New York City," by A. J. Herschmann (New York).

PRIVATE BILLS IN PARLIAMENT.

NEW ENGINEERING SCHEMES.

GOVERNMENTS may come and go, but the industry of promoting private bills prevails through all the changes and chances of Parliamentary life. The number of private bills is about the same as usual, and it will be interesting to call attention to the important engineering schemes outlined in the private Bills printed in recent issues of the London Gazette. Certain of these projects are of real importance, and these are briefly summarised below.

First place may, perhaps, be accorded to the various Bills forsupplying electric power to the London district. It is clear that this rich field offers great attractions, and Parliament is to be called upon to decide difficult points in this connection.

ELECTRIC POWER FOR LONDON.

Among the electric power schemes which are merely revivals, is the Bill of the Administrative County of London Company. Last Session this company stood practically alone in its proposal to supply cheap electric power to the London area, and the details of the scheme are sufficiently familiar to obviate the need for giving particulars at this juncture. Substantially, the scheme is that which just missed being added to the Statute Book a few months since.

The London County Council is, doubtless, the most formidable new competitor in the field, and it proposes to seek very wide powers to supply electrical energy in the County of London and neighbouring county boroughs in Essex, Kent, Surrey and Middlesex. A site at Battersea, appears to have been fixed upon for the generating station, which gives a frontage to the River Thames of about 530 ft., with access to the low-level line of the London, Chatham and Dover Railway, and the London, Brighton and South Coast Railway. Further particulars of this scheme will be awaited with great interest, the more particularly as there is a disposition to regard the attempt on the part of the Council to enter this particular field as an example of municipal madness. It must be admitted that up to the present time municipal enterprises have proved an illusion in the direction of affording relief to the rates.

Another entirely new scheme of which some particulars have already been given in this journal, is that which bears the title of "Additional Electric Power Supply (London) Bill." Briefly, the proposal is to establish the generating station near St. Neots, on the Ouse, Huntingdonshire, and to convey the current on overhead wires to Enfield, along the Great Northern Railway; at Enfield three cables will be substituted for the overhead conductors. Of these, one will follow the line of the River Lea into East London; a second, the Great Northern Railway to Finsbury Park, and thence along the Regent's Canal; the third will follow the railway to King's Cross, and thence by the roads to the same canal. All three cables will terminate on this canal, and act as feeders to a distributing main laid under the towpath of the latter. Except in the case of supply to railways tramways, and similar undertakings, for which existing supply companies are not competent to cater, the promoters only ask for powers to supply to authorised distributors; but it is proposed to make it a condition of supply to the distributors that they shall only make a reasonable profit on the cost at which energy is supplied to them. In other words, the middleman's profits are to be strictly limited. This company aims at a charge of ½d. per unit.

A KENT COAL SCHEME.

Yet another bill is that in connection with the Kent Collieries. A generating station is proposed to be erected on the coalfield, and current is to be brought to London along the railway lines on much the same plan as that of the bill just referred to. The weak point of the scheme is that the Kent coalfield does not appear to have reached the stage of development when it could be depended upon to feed a large generating station. Probably, it is considered that by the time the bill becomes law Kent coal would have entered upon the commercial stage, and one hopes that such may prove to be the case.

FRESH POWERS FOR EXISTING COMPANIES

[illegible] to [illegible] the Charing Cross, [illegible] and City Companies are promoting [illegible] covering much the same area as the scheme of the Administrative County of London Company, and are proposing to considerably enlarge their generating station at Lambeth.

The Metropolitan Electric Supply Company, Ltd., is promoting a bill to extend its district, to include Ruislip Northwood, Rickmansworth, Chorley Wood, and Chesham, Beaconsfield, Amersham, Windsor, Eton and Slough, and part of Wycombe. Some [illegible] along the Grand Junction [illegible]

The City of London Electric Lighting Company is also seeking to extend its limits of supply and to have powers to supply current in bulk to railway and other companies, and to local authorities.

A bill is also brought forward to authorise the existing London companies to supply each other, and local authorities, railways, etc., and to combine to erect a joint station, if desired.

Another bill is that of the West London Electric Undertakers' Association, which includes the following companies: — Westminster Electric Supply, St. James's and Pall Mall Electric Light, Kensington and Knightsbridge Electric Lighting, Notting Hill Electric Lighting, Metropolitan Electric Supply, Chelsea Electricity Supply, and Brompton and Kensington Electricity Supply Companies. In this case powers are taken to erect new generating stations on the Thames at Fulham, and at Pimlico. It is also sought to transfer to the St. James's and Pall Mall and Chelsea Companies the interests of the London Electric Supply Corporation in Westminster and Chelsea.

There are also a number of provincial power schemes which are the subject of private bills.

RAILWAY COMPANIES BILLS.

The railways' schemes to be submitted to Parliament do not suggest the prolonged Parliamentary battles which clearly await the new rival power schemes. The most important bill is, perhaps, that by which the Great Central Company seeks authorisation to absorb the Lancashire, Derbyshire and East Coast Railway. This company is also interested in the bill being promoted by the Hull and Barnsley Company, under which the powers already obtained for the construction of the Rotherham, Maltby and Laughton line are to be transferred to the Great Central Company.

In the case of the Metropolitan Railway Company, chief interest will centre in the introduction of a clause into their bill providing for a penalty of forty shillings in the case of a workman's ticket being used by other than a bona fide workman. Even granting [illegible] deal of business awaits His Majesty's judges in the attempts to obtain a proper definition of the expression "bona fide workman." The Metropolitan District Railway Company propose to construct a new line from Earl's Court to Shepherd's Bush Green.

An interesting new scheme is embodied in the bill of the London and Outer Circle Railway. The main object of the company would appear to be to connect up all the railways North of the Thames with the London and India Docks. There are junctions with the Great Western Railway, the North Western, the Midland, Great Northern, the Great Central, the Great Eastern, London and South Western, the London, Tilbury and Southend, and the Metropolitan. The Hammersmith, City, and North-East Railway Company's bill proposes the construction of a line from Chiswick to Hammersmith, thence by way of Kensington to Piccadilly, with an extension to Gracechurch Street, in the city. Generating stations are proposed to be built at Hammersmith, Lambeth, and on the Regent's Canal, by the Kingsland Road.

CHANNEL FERRY.

[illegible] Railway [illegible] Dover [illegible] bill of [illegible] siderable interest. It is proposed to construct a pier commencing at a point near the west end of the Dover Town station of the South Eastern Railway Company, extending seawards for a distance of 500 yards, in a south-easterly direction. The pier and the Admiralty pier will form a small harbour with an entrance 100 yards or thereabouts wide, for the ingress and egress of ships, vessels and boats, and in connection with this is to be constructed a movable incline bridge for shipping the wagons, fitted on the eastern side of the proposed pier, at about the middle of its length, and 120 yards long. A railway is also to be constructed, commencing by a junction with the railway from Folkestone to the South Eastern Railway Company's Town station at Dover, at a point near the east end of the tunnel carrying the South Eastern Railway under the Archcliffe Fort to Dover Town station, and extending on and along the pier, and connecting with the movable incline bridge.

If this scheme goes through it will be possible to go through to Paris without changing.

An important new railway undertaking, involving the construction of fifty miles of line and opening up another portion of the Lancashire coalfield, has been

made the subject of a private Bill. We refer to the Wigan, Preston, Blackpool and Lancaster Railway which proposes to link up Wigan, Preston, Blackpool, and Lancaster by an entirely new route, making a junction withqthe Midland [illegible] Heysham line at Lancaster. The railway will start from the Great Central Company's station at Wigan and will go via Standish and Eccleston to Preston. Thence the line will go to Kellett's Bridge, the junction for Blackpool, and a remarkably straight piece of line will continue it to Lancaster. The route surveyed presents no particular features of engineerlng interest. Messrs. Parry and Bidder are the engineers to the company.

THAMES BARRAGE.

A bill in connection with the River Thames which is certain to attract universal attention is the proposal to construct a dam, lock, and weir at Gravesend, and realise the much-discussed Thames barrage. The dam would be placed at a point 166 yards, or thereabouts, east of the south-east pier of the entrance gates to the Gravesend Town pier, and would terminate at a point 100 yards, in a south-easterly direction from the south-east corner of the "World's End," Chadwell, on the Essex shore.

It is proposed to incorporate a body of commissioners representing the various interests involved, who would take over the powers now exercised by the conservators of the River Thames, and also all the control in the hands of the Watermen's Company, the Court of the Watermen's Company, the Corportaion of London, the London County Council, and the Corporation of Trinity House so far as relates to the River Thames between the proposed dam at Gravesend and the existing weir at Teddington. It is also proposed to acquire by agreement control over the water areas of any docks opening into the River Thames within the limits of the intended Act, and to indemnify the owners.

LONDON AND BRIGHTON MOTOR ROAD.

Reference was recently made in PAGE'S WEEKLY to the proposed motor roads between London and Brighton, and the bill has now been deposited. The motor road would be just over forty miles long, commencing on the western side of the London and Croydon road, and terminating at Patcham, Sussex, on the western side of the London and Brighton Road. The route would be via Merstham, Nutfield, Horley, Charlswood, Worth, Balcombe, Cuckfield, Clayton and Patcham, roughly following the route of the London, Brighton and South Coast Railway's Brighton line. Power is sought to put up electric generating stations for lighting the roads, and authority is asked to levy tolls on users of the road.

NEWS ITEMS.

Corrosion of Metal by Water.

At the meeting of the Birmingham Scientific Society this week, Mr. Alex. E. Tucker read a paper on the "Corrosion of Metal by Water," in which he dealt with the very serious losses and danger involved in the corrosion of iron pipes, boilers, etc. Specimens were shown in which such plates and tubes of boilers had been completely perforated, and had the appearance of being eaten through with acid. The shortness of time required for such perforation was often remarkable, and he had known instances of iron plates $\frac{3}{16}$ in. thick being perforated in six months where the water acting on them was of otherwise excellent quality. Mr. Tucker showed that neither oxygen nor carbolic acid was sufficient to produce rust; both required the presence of water, and when the two were together the carbonate of iron formed was decomposed with the liberation of carbonic acid. This was free to again form carbonate of iron, and so the attack went on continuously until the iron was entirely eaten away. Galvanic action set up by foreign bodies often gave great trouble in iron structures, and it seemed that the feeble currents produced by two plates of steel of only slightly different composition were sufficient to seriously corrode the work if continued long enough.

Lateral Vibration of Bars.

A method of calculating the frequency of the lateral vibration of bars was described by Mr. John Morrow in a recent paper, "On the Lateral Vibration of Bars of Uniform and Varying Sectional Area," read before the Physical Society. It is an important feature of this method that it gives, in a simple form, the equation of the elastic central line of the displaced bar, and thus provides data from which the stresses and strains in all parts may be readily calculated. The method lends itself to many cases of loaded bars which have not hitherto been solved, and in the paper just presented Mr. Morrow, after dealing with some cases of unloaded bars under different end conditions, and bars of negligible mass carrying concentrated loads, gives more particularly the solutions for some important problems of loaded bars of appreciable mass. These solutions are, in general, obtained by a process of continuous approximation. Each approximation depends on the principle that, at any point in the length of the bar, the curvature is equal to the couple due to the reversed effective forces divided by the flexural rigidity. To estimate the value of the couple a vibration-curve must be assumed. The above principle then gives an expression for the curvature at all points.

SHIPBUILDING NOTES.

SATISFACTORY progress is being made with the building of the three turbine steamers, *St. Patrick*, *St. David*, and *St. George*, intended for the new service to Ireland viâ Fishguard and Rosslare. The two former vessels are being constructed by Messrs. John Brown and Co., and the latter by Messrs. Cammell, Laird and Co. The dimensions of each of the steamers are: Length, 350 ft.; breadth, 41 ft.; depth, 17½ ft.; and it is hoped to attain such a speed as will reduce to a minimum the most direct sea passage between the two countries.

The large turret steamer, *Belle of France*, built by Messrs. Wm. Doxford and Sons, Ltd., Sunderland, for Messrs. Crow, Rudolf and Co., Liverpool, completed her sea trials on the 30th ult., and proceeded to Leith for loading. The same firm recently launched a large single-deck turret steamer, built to the order of Messrs. James Mathias and Sons, of Cardiff and Aberystwyth, named the *Carthusian*. She will carry 6,800 tons on a draft of 22 ft., and is a duplicate of the *Pearlmoor*, recently launched for Messrs. Walter Runciman and Co., Newcastle.

On Saturday last the steel-screw steamer *Albiana*, built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy and Co., Ltd., West Hartlepool, left the Tyne for her trial trip. The steamer is 360 ft. long by 48 ft. beam by 30 ft. 10 in. deep, and has been built under special survey to the highest class at British Corporation. A complete outfit for the rapid handling of cargoes has been arranged for, consisting of eight steam winches by Messrs. John Lynn and Co., Sunderland, a large number of cargo derricks, steam-steering gear by Messrs. Hastie and Co., Greenock, and steam windlass by Messrs. Emerson, Walker and Thompson Bros. The machinery has been supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 69 in. by 48 in., three large steel boilers, 14 ft. by 10 ft. 9 in., 180 lb. working pressure. The steamer will carry about 7,250 tons loaded. At the conclusion of the trial trip, when a speed of 11 knots was obtained, the vessel sailed for Newport News.

The s.s. *Gracefield*, which has been built by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., Wallsend-on-Tyne, to the order of Messrs. E. J. Sutton and Co., of Newcastle, was taken out to sea on the 30th ult. for her trial trip. She is of the following dimensions: Length overall, 324 ft. 6 in.; beam, extreme, 46 ft. 6 in.; depth moulded, 23 ft. 1 in.; deadweight about 4,600 tons, on a moderate draught of water. The machinery constructed by the shipbuilders, consists of a set of triple expansion engines, having cylinders 22 in., 37 in., and 62 in. diameter, with a stroke of 42 in.; steam is supplied by two large single-ended boilers, working at 180 lb. pressure.

From the yard of the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, on Tuesday, the 28th ult., was launched a steamer built to the order of Messrs. Furness, Withy and Co., Ltd., West Hartlepool, for Messrs. The Howard Smith Company, Ltd., of London and Melbourne. She is 372 ft. long, by 48 ft. beam, by 30 ft. 10 in. depth moulded. Eight steam winches are being supplied by Messrs. John Lynn and Co., Sunderland, a large number of cargo derricks, steam-steering gear by Messrs. Hastie and Co., Greenock, and steam windlass by Messrs. Emerson, Walker and Thompson Bros. The machinery will be supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 69 in. by 48 in., three large steel boilers, 14 ft. by 10 ft. 9 in., 180 lb. working pressure. The steamer will carry about 7,250 tons loaded, and is expected to steam about 10 knots speed.

The s.s. *Herefordshire*, built by Messrs. Harland and Wolff, Ltd., to the order of Messrs. Bibby Bros. and Co., Liverpool, for their Eastern trade, left the harbour last week. The vessel is 452 ft. long by 54 ft. broad, by 34 ft. 6 in. deep, with a gross tonnage of between 7,000 and 8,000 tons. The machinery has also been constructed at Messrs. Harland and Wolff's works, and is on the quadruple-expansion system. After a satisfactory trial and adjustment of com passes, the *Herefordshire* left for Liverpool.

An important addition was made last week to the fleet of the Ocean Steamship Company, Ltd., of Liverpool, by the launch of the *Bellerophon*, a large twin-screw steamer from the north yard of Messrs. Workman, Clark and Co., Ltd., Belfast. She has a gross tonnage of upwards of 9,000, and is one of four that is being built of the same class for these owners. A notable feature of this vessel is the absence of masts, the derricks being stepped and swung from specially built derrick posts, which serve also as hold ventilators. The propelling machinery, constructed at the Queen's Road Engine Works of the builders, consists of two sets of triple-expansion engines, with steam from double-ended multitubular boilers working at a pressure of 190 lb. per square inch.

THE TECHNICAL LIBRARY.

BIBLIOGRAPHY No. 4.—ELECTRICAL WORKS *(Continued)*.

ELECTRICAL INSTRUMENTS, MEASUREMENTS AND TESTING.

Crapper, E. H. Practical Electrical Measurements. An Introductory Course in Practical Physics for students and engineers. With 56 illustrations. Second edition. 2s. 6d. Whittaker.

Day, R. E. Exercises in Electrical and Magnetic Measurements, with Answers. 12mo, 3s. 6d. Longmans.

Electrical Measuring Instruments, Small. Describes the Making and Using of Galvanometers, Voltmeters, etc. Fully illustrated. 6d. P. Marshall.

Gray, Professor A. Absolute Measurements in Electricity and Magnetism. Second edition, revised and greatly enlarged. Fcap 8vo. 5s. 6d. Macmillan.

Gray, Professor A. The Theory and Practice of Absolute Measurements in Electricity and Magnetism. 2 vols. Crown 8vo. Vol. I. 12s. 6d. Vol. II. In two Parts. 25s. Macmillan.

Hobbs, W. R. P., Naval Torpedo School, Portsmouth. The Arithmetic of Electrical Measurements: With examples. 1s. net Murby.

Houston. Electrical Measurements, and other Advanced Primers of Electricity. Crown 8vo, cloth. 2s. 6d. Specs.

Kempe, H. R. A Handbook of Electrical Testing: Sixth edition. 238 illustrations. Demy 8vo. 18s. Spon.

Kinzbrunner, C., A.M.I.E.E. The Testing of Continuous Current Machines in Laboratories and Test Rooms: 6s. net. Harpers.

La Cour T., and Arnold A.: Testing of Alternating Current Machines. Translated from the German by C. Kinzbrunner, A.M.I.E.E. Harpers.

Palaz, A. Industrial Photometry: With Special Application to Electric Lighting. Translated from the French by G. W. Patterson. Illustrated. 8vo, 12s. 6d. Sampson Low, Marston.

Parham, E. C., B.Sc., and Shedd, J. C., M.S. Dynamos and Motors, Shop and Road Testing of. 2nd edition. 63 pp. 8vo. cloth. 10s. 6d. net. Spon.

Parr, G. D. A., M.I.E.E., A.M.I.Mech.E. Electrical Engineering Measuring Instruments. For Commercial and Laboratory Purposes. Fully illustrated. 5s. net. Blackie.

Schneider, N. H. Electrical Instruments and Testing. How to use the Voltmeter, Ammeter, Galvanometer, Potentiometer, Ohmmeter, and the Wheatstone Bridge. 105 illustrations. 200 pp., crown 8vo, cloth, 4s. 6d. net. Spon.

Smith, C. F., Wh. S., A.M.Inst.C.E. Practical Testing of Dynamos and Motors. 5s. Scientific Publishing Co.

APPLICATION TO MINING, WORKSHOPS, ETC.

Burns, D., M.Inst.C.E. Electrical Practice in Collieries. Second edition. Revised and enlarged. 8vo. 7s. 6d. net. Charles Griffin.

de Graffigny, H. Industrial Electricity. An Introductory Volume on Electro-Technics. Adapted from the French of H. de Graffigny. By A. G. Elliott, B.Sc. With 65 illustrations. 2s. 6d. Whittaker.

Houston, E. J., and Kennelly, A. E. Electric Heating. With 50 illustrations. 4s. 6d. net. Spon.

Lupton, A., Parr, G. D. A., and Perkin, H. Electricity as Applied to Mining. With about 170 illustrations. Second edition, revised and enlarged. Medium 8vo, cloth. 10s. 6d. net. Crosby Lockwood.

Stewart, A., A.M.I.E.E. The Application of Electric Motors to Machine Driving. Third edition. 2s. Rentell.

Thwaite, B. H. Generation and Transmission of Electric Energy at and from Coal Pit centres. By B. H. Thwaite. 8vo, sewed. 2s. 6d. net. Spon.

Walker, S. F., M.I.E.E. Electricity in our Homes and Workshops. A Practical Treatise on Auxiliary Electrical Apparatus. Third Edition, revised and enlarged. With 143 illustrations. 10s. Whittaker.

ELECTRO-METALLURGY, ETC.

Andrews, T. Thermo-electric Reactions and Currents between Metals in Fused Salts. 8vo, sewed. 1s. Spon.

Arrhenius, S. A Text-Book of Electro-chemistry. Translated from the German Edition. by John McCrae, Ph.D. With 58 illustrations. 8vo, 9s. 6d. net. Longmans.

Bonney, G. E. The Electro-Platers' Handbook. A Practical Manual for Amateurs and Young Students in Electro-Metallurgy. With 61 illustrations. Revised and enlarged, with an Appendix on Electrotyping and a section on Nickel-Plating for Cycles. 3s. Whittaker.

Borchers, Dr. W. Electric Smelting and Refining: The Extraction and Treatment of Metals by means of the Electric Current. Translated from the third German edition, with additions by Walter G. McMillan, F.I.C., F.C.S. 21s. Charles Griffin.

Gregory, J. C., B.Sc. The Theory of Electrolytic Dissociation. A Short Introduction. 1s. 6d. Longmans, Green.

McMillan, W. G., F.I.C. Electric Smelting and Refining: Translated from the German of Dr. W. Borchers. Second edition. Revised and enlarged. 21s. net Charles Griffin.

McMillan, W.G., F.I.C. A Treatise on Electro-Metallurgy: Second edition, Revised. Fully illustrated. 10s. Charles Griffin.

Moissan, H. Experimental Researches with the Electric Furnace: Authorised English Edition. Translated by A. T. de Mouilpied, M.Sc., Ph.D. 307 pages, with illustrations. Demy 8vo, cloth, 10s. 6d. net. Paper, 10s. net. E. Arnold.

Wright, J. Electric Furnaces: Demy 8vo. With 57 illustrations. 8s. 6d. net. A. Constable.

(To be continued.)

OPENINGS FOR TRADE ABROAD

Portuguese India.

A consular report states that the Government of Portugal have under consideration a scheme for harbour improvements and extension of railway sidings in Goa, amounting to some £3[illegible].

Cuba.

The Secretary of Public Work has received from Mr. G. F. Greenwood, the representative of the Cuban Electric Company, an application for permission to construct and work electric tramways in Regla and Guanabacoa.

Siberia.

A special commission has been formed under Count Solski for the purpose of discussing the question of obtaining new rolling stock for use on the Siberian railway system, which, as the result of its having been used to such an extent by the military authorities during the recent war is now practically unfit for service.

India.

The South Indian Railway Company, Ltd., are prepared to receive, until the 12th inst., tenders for the supply of (1) general stores, comprising hardware, iron steel, metals, electrical stores and sundries; (2) locomotive stores, comprising copper and steel plates, tyres, axles, springs, brass and steel tubes and trollies; (3) iron wire fencing, 40 tons; and (4) roofing—five roofs, 100 ft. by 25 ft.—44 tons. Specifications and forms of tender may be obtained at the Company's offices, 55, Gracechurch Street, London, E.C.

New Zealand.

The British Empire Motor Trades Alliance, Ltd., has received an inquiry from Geraldine, New Zealand, for light touring motor-cars, two cylinders to seat four without luggage, or two with luggage, 2 ft. clearance under engine for crossing creeks, weight not to exceed 15 cwt., simplicity and reliability essential points. British manufacturers of the above are requested to communicate with Mr. J. B. King, secretary, 11, Leicester Square, W.C.

British North Borneo.

According to Reuter's Agency it has been decided to construct a railway across British North Borneo, to form a continuous connection between the east and west coasts. The extension will commence at Tenom, 90 miles from Jesselton, and, traversing some of the most valuable timber lands of British North Borneo, [illegible] the east coast. The extension is estimated to cost £1,500,000, and will be constructed in sections.

British India.

A recent consular report calls attention to the increased use of motor cars and motor cycles noticeable in Bombay, Calcutta and Madras during the last two years. Moreover, in various parts of India several schemes have been put forward for motor service to link up important centres and to connect health resorts with the nearest railway. The writer remarks that the natives attach no importance to speed when purchasing a car, preference being given to a strong and trustworthy article. A voiturette, light enough to be carried by bearers across the fords which have so often to be traversed in India, with wheels as high as possible in order to be able to cross the more shallow fords unassisted, retailed at a price not exceeding £160, should, says the Consul, command a ready sale.

South Australia.

Tenders will be received at the Supply and Tender Board Office, Adelaide, up till Wednesday, January 17th 1906, for the supply of the following materials, delivered in bond, on Ocean Steamers wharf, Port Adelaide, wharfage to be paid by contractor: 39 best mild steel boiler plates; 21 best mild steel boiler plates for flanging; 3 best mild steel smokebox tube plates for flanging (one drawing, 1s.); 3 copper tube plates, flanged (one drawing, 1s.); 3 copper back plates, flanged (one drawing, 1s.); 3 copper wrapping plates; 9 bars of best Yorkshire angle iron (two drawings, 1s. each); 3 bars of best Yorkshire tee iron (one drawing, 1s.); 100 bars of best soft rolled copper; 128 bars of best Yorkshire iron; 650 solid drawn best toughened copper tubes; 30 mild steel frame plates; 108 best crucible cast steel horn blocks and tops (three drawings, 3s. each, two drawings, 1s. 6d. each); 12 best crucible cast steel slide bars (one drawing, 1s.); 18 bars of coping iron (two drawings, 1s.); 27 bars of channel steel (two drawings, 1s. each); 3 solid drawn best copper steam pipes; 53 solid drawn best copper pipes; 171 mild steel plates; 39 plates of charcoal iron on B.B.S.; 21 bright weldless steel tubes; 3 circular plates of best Yorkshire iron; 3 steam pressure gauges (one drawing, 1s. 6d.); 3 spiral springs for locomotive safety valves (one drawing, 1s. 6d.). Specifications may be seen at the office of the Agent-General for South Australia, 28, Bishopsgate Street Without, E.C.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day

Halifax. Supply of about 415 tons of cast-iron pipes, from 24 in. to 12 in. diameter, including irregulars, for the Corporation. Messrs. G. H. Hill and Sons, civil engineers, 3, Victoria-street, Westminster, and Albert Chambers, Albert-square, Manchester ... ... Dec. 11

Basingstoke.—Contract No. 2. Supply, delivery, and erection of suction gas plant, gas engines, and pumping machinery (all in duplicate) in connection with the new waterworks. Waterworks Engineer, Town Hall, Basingstoke ... Dec. 12

Newcastle-upon-Tyne.—For the construction of a Hennebique patent ferro-concrete culvert in the valley of the Ouseburn, and other appurtenant works thereto, for conveying the waters of the burn, for the Corporation. City Engineer's Office, Town Hall, Newcastle-upon-Tyne Dec. 12

Poplar.—Supply and erection of the following plant at the Children's Homes and Schools, Hutton, Essex—Section X. Steam engines, dynamos, pipework, &c. Section Y. Part 1. Main switchboard, wiring, motor, &c. Section Y. Part 2. Fire alarms, telephones, and electric bells. Mr. Albion T. Snell, M.Inst.C.E., Suffolk House, 5, Laurence Pountney-hill, Cannon-street, E.C.... ... ... Dec. 13

Glasgow.—The Trustees of the Clyde Navigation invite tenders for—(1) One 20-ton hand or electric overhead travelling crane for the Electric Power Generating Station; (2) Six electrically-driven quay capstans and two electrically-driven double-geared pierhead capstans, and (3) two electrically-worked tipping turntables. Mr. George H. Baxter, mechanical engineer, Clyde Navigation, Glasgow Dec. 18

Derby.—Supply and delivery of materials and construction of works in connection with the conversion of existing single line into double line, from Deadman's Lane, to Navigation Bridge, for the Tramways Committee. The length of work is about 720 yds. Mr. John Ward, M.Inst.C.E., borough surveyor and engineer ... ... Dec. 19

Elham (Folkestone). — One or more superheaters for the Elham Union; also a Lancashire boiler. Mr. R. Lonergan, clerk, 11, Cheriton Place, Folkestone ... Dec. 27

Southsea. — Extension of pier, for the Southsea Clarence Esplanade Pier Company. Mr. Alfred H. Bone, 148, High Street, Portsmouth ... ... Jan. 16

COMING CONTRACTS.

Torquay.—The Local Government Board has, after nearly 12 months, sanctioned the enlargement of the electrical station, at a cost of about £10,000, in order to provide current for trams.

London County Council.—At Tuesday's meeting it was resolved to loan Southwark £5,942 and Battersea £10,891 for electric lighting purposes.

Holyhead.—Colonel D. G. Durnford, has held an inquiry relative to the Council's application for sanction to borrow a further sum of £3,000 towards electric light extensions.

West Kirby.—The Urban District Council wish to borrow a sum of £4,700 for purposes of sewerage and private street works, and an inquiry has been held.

Scunthorpe.—An application has been made to the Local Government Board for sanction to borrow £4,500 for electric lighting.

East Ham.—The Council have adopted an estimate of the electrical engineer and manager (Mr. W. C. Ullman) for cable extensions, etc., at a cost of £20,000. It is proposed to put in electric motors for pumping at the sewage works, and the engineer (Mr. A. H. Campbell) has decided to use the engine and generator recently superseded at the electricity works for supplying electric energy.

Scarborough.—The Marine-drive Sub-Committee have decided to submit a plan to the tramway company for the construction of tramways round the drive, which connects the North and South Bays, and is costing over £100,000 to construct.

Walthamstow.—Application is to be made to the Local Government Board for sanction to borrow £10,000 for electric lighting extensions.

CONTRACTS CLOSED.

Storthes (Yorks.) — Messrs. S. Dixon and Sons, Limited, have secured the contract for two 80 k.w. steam-dynamos with Willans and Robinson engines, for the West Riding of Yorkshire County Council, Storthes Asylum. They have also secured an order from the Preston Corporation Tramways for one sample Turner's patent automatic point controller.

Brighton.—The Town Council have accepted the tender of the British Westinghouse Electric and Manufacturing Company, at £1,462 10s., for the installation of a motor-generator at the Southwick power station in connection with the supply of electricity to Aldrington; and that of the British Thomson-Houston Company, at £670, for the provision of a switchboard for controlling the low-tension circuits for Aldrington, the lighting, and the auxiliary motors at the Southwick power station

Beckenham.—In connection with the extension of the electric light work to supply the Penge tramways, the Council has accepted the tenders of Messrs. Babcock and Wilcox, Limited, for boilers, at £3,375, and for pipe work, at £1,750. The contract for engines and dynamos has gone to the General Electric Company, and that for the condensers to Messrs. The Mirrlees Watson Company, while the switchboard is to be supplied by Messrs. Elliott Brothers, at £54.

Manchester.—Edward G. Herbert, Ltd., Manchester, have received for the Admiralty three full automatic circular sawing machines for cutting brass and copper bars and tubes up to 3 in. diameter. These machines feed the bar forward and make successive cuts automatically. Other orders from the Admiralty include a "Gill" sawing machine for gun-metal castings, and two No. 3 eccentric sawing machines for cutting steel bars, etc., up to 20 in. by 12 in. The firm have also received a repeat order for an eccentric saw for the Ordnance Department, Woolwich Arsenal, and have in hand one of these machines with independent motor drive for the London County Council Tramways.

Derby.—The Glass Houghton and Castleford Collieries, Ltd., have entrusted John Davis and Son (Derby), Ltd., with an order for a duplicate Norwalk compressor. The first was supplied about two years ago, and has been employed in driving coal-cutters, etc. The displacement is 3,780 cubic feet per minute. The same company have received many repeat orders for their Jeffrey double reduction drill, which is employed chiefly in "rippings" for drilling shot holes.

Bolton.—Messrs. Edw. Bennis and Co., Ltd., of Little Hulton, Bolton, inform us that they have received the following orders:—The Wimbledon Urban District Council for its Electric Lighting Station, a repeat order for four stokers and compressed air furnaces for their water-tube boilers. The Swadlincote (Derby) Urban District Council, two stokers and compressed air furnaces. The Rugby Urban District Council for its Electric Power station, two sets of stokers and natural draught furnaces for Babcock and Wilcox boilers. Messrs. Clarke, Chapman and Co., Ltd., one set of "Bennis-and-Miller-Bennett" chain grates. The Patent Shaft and Axletree Co., Ltd., 46 stokers and compressed air furnaces, with complete coal and ash handling plant for their various works at Wednesbury. The Babington Coal Co., Ltd., Nottingham, repeat order for six stokers and compressed air furnaces, making a total of 23 supplied to this firm.

Taunton.—Messrs. Newtons, Ltd., of Taunton, are shipping to the Jubilee Gold Mining Company, Johannesburg, a large generator and two motors of their Mawdsley type, together with main switchboard, and two controlling panels.

South Australia.—The Audley Engineering Company, of Newport, Salop, have secured a contract from the South Australian Government for the supply of plans and machinery for, and general laying-out of, a large vertical cast-iron pipe foundry.

Fleetwood.—For service at Fleetwood the London and North-Western and Lancashire and Yorkshire Joint Railway Companies are reported to have ordered from Messrs. Ferguson Brother, Port Glasgow, a powerful bucket hopper-loading dredger.

Chesterfield.—Messrs. Markham and Co., (Chesterfield) have secured a large portion of the contract for the Great Central new wagon shops at Dukinfield which are to cover an area of 23 acres.

Sydney.—The Council are recommended to accept the tender of Noyes Brothers, for paper-insulated [illegible] cables at £[illegible] 18s. 3d., delivery to be made within 14 weeks.

APPOINTMENTS VACANT.

Malay States. There are vacancies for telegraph inspector at £225 per annum and for electrical mechanician at £225 per annum. Crown Agents for the Colonies, Whitehall Gardens, S.W. ... Dec. 12

Cape Town.—Applications are invited for the newly-founded Professorship of Electro-Technics in the South African College, Capetown. Salary £600 per annum. Agent-General for Cape Colony, 100, Victoria Street, London, S.W. Dec. 15

Cork.—The Cork County Borough Council will receive applications for the office of resident mechanical engineer at the pumping station, Cork Waterworks. Salary, commencing at £200 per annum ... ... Dec. 21

India.—Bombay, Baroda, and Central India Railway Company, invite applications for appointment as a chief draughtsman, in the carriage and wagon department of the company's service. Salary Rs. 400 per calendar month. Mr. T. Wood, secretary, Gloucester House, Bishopsgate Street Without, E.C. ... ... —

Burma Railways.—The Directors of the Burma Railways Co. invite applications for appointment as assistant carriage and wagon superintendent, to take charge of the carriage and wagon shop at Insein, under the locomotive and carriage superintendent. Mr. A. G. Begbie, Managing Director, 76, Gresham House, E.C. Dec. 21

Auckland, New Zealand.—Applications are invited for the appointment of City Engineer to the City of Auckland. High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W. Feb. 8

APPOINTMENTS FILLED.

Lagos.—Mr. Claude Hull, who for the past ten years has been engaged in the office of the city surveyor of Hereford, has been appointed assistant executive engineer in the Public Works Department at Lagos, West Africa.

Kendal.—The Kendal Town Council have offered Mr. Cluças a salary of £300 per annum for his services for a period of two years from the month of January next, the amount being represented by £215, the nominal salary of borough engineer and surveyor and £85 for special engineering services in connection with sewage disposal and other engineering works in contemplation.

Leeds.—Mr. H. Hulse has been appointed permanently to the position of gas manager at Leeds, at a salary of £300 per annum, in succession to the late Mr. Tooley.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols, Jan. 4th. General Settlements: Dec. 14th, 29th; Jan. 11th, 25th. Bank Rate, September 28th, 1905, 4 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
11,370	5	5%	Addays & Onions Pneumatic Engineering, Ltd.	3	2⅝ — 2⅞
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4¼ — 5¼
8,210,000	1	1-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3⅛ — 3⅜
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5 — 5⅛
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	103 —105
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt Debs Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord ..	1	3¾ — 4
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1⅛ — 1⅜
20,000	5	3/-	Baker (Joseph) and Sons, Ltd. 6% Cum. Pref.	5	5 — 5½
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1⅛ — 1⅜
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	/-	Barrow Hæmatite Steel Co., Ld., O	4½	5 — 5½
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	5 — 5¼
32,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	4½	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red..Scrip 50% pd	—	104—106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12½ — 13
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	⅞ — 1
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	⅝ — ¾
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	93 —96
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1⅛ — 1⅜
1,860,900	1	3¾d.	Do. Nos. 1,639,101-3,500,000	12/-	½ — ⅝
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅜ — 1⅝
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅜ — 2
74,000	10	5/-	Do. 5% Cum. Pref.	10	11¼ —12
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord..	5	10¼ —11
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5¼ — 5½
450,000	1	1/2½	Clayton & Shuttleworth, Ltd., Ord.	1	⅞ — 1
70,000	5	2/6	Do. 5% Cum. Pref	5	5¼ — 5½
£250,000	Stk	4%	Do 4% 1st Mort Db. Stk. Red	100	100 -102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.. ..	7½	35 — 36
57,031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	15¾ —16
40,339	10	5/-	Do. 5% Cum. Pref.	10	11¼ —11¾
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2⅜ — 2⅝
1,259,594	1	3½d.	Dorman, Long & Co., Ltd.	1	⅛ — ¼
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	92 —95
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3¾ — 4¼
250,000	1	6d.	Dunlop (James) & Co., Ltd., Ord...	1	⅛ — ⅜
300,000	1	7½d.	Do. 6% Cum. Pref.	1	⅜ — ½
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	10¾ - 11½
69,754	13	10/-	Do. do. do.	10	8¾ - 9¼
20,250	10	5%	Elliott's Metal, Ltd.	8	5 — 5½
5,600	10	5%	Do. Cum. Pref. 5%	10	8¾ — 9¼
186,748	Stk	4%	Do. Deb. 4%	100	90 — 94
25,000	10	0%	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	11¼ - 12¼
£250,000	Stk	4%	Do. 4% Mort. Deb. Stk. Red.	100	100 —103
120,000	3	1/-	Fraser & Chalmers, Ltd., Ord. ..	3	3⅜ — 4⅛
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾ — 6¼
10,000	10	5/-	Gall Sons, Ltd., 5% Cum. Pref. 18001/28000	10	7½ — 8
£150,000	Stk	4%	Do. 4% 1st Mort Deb Red .	100	88¾ — 89½
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	6½ — 7
9,600	10	7½%	Do. 7% Cum. Pref.	10	10½ — 11¼
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅛ — 2⅜
344,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6¼
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	106 —108
13,000	5	2/-	Gwynnes, Ltd., 5% Cum. Pref.	5	2¾ — 3¼
250,000	1	1	Hadfield's Steel Fdry Co., Ld., Ord.	1	¾ — 1
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
20,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	4¾ — 5¼
108,500	1	1/-	Harvey United Steel Co., Ltd. ..	1	¾ — 1
47,500	10	7½	Hawthorn, Leslie & Co., Ltd. Ord.	10	98 — 100
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5¾ — 6
85,000	1	7½	Hill (Richard) & Co. (1899) Ld., Ord.	1	⅜ — ½
18,000	5	5%	Do. 6% Cum. Pref.	5	5 — 5¼
£100,000	Stk	6%	Hopkinsons (Charles) & Sons, Ltd., Ord. Cum. Pref.	100	104 - 106

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
750,000	1	7½	Howard & Bullough, Ltd., Ord, ..	1	1⅜ - 1⅝
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12½—13
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	18½—18¾
49,537	10	5%	Do. Cum. Pref. 5%	10	10½—11
300,000	1	4½d.	Lambert Bros., Ltd, Ord.	1	⅞ — 1
50,000	5	2/9	Do. 5½% Cum. Pref	5	4½—4¾
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref. ..	3	4 — 4½
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1⅛—1⅜
£300,000	Stk	4½%	Do 4½% 1st Mt Deb. Stk., Red.	100	110 —112
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref.	10	11½—11¾
210,000	1	Red.	Measures Bros., Ltd., Ord.	1	⅛ — 1⅛
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	1⅛ — 1⅜
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	98 — 101
21,943	5	2/6	Muntz Metal, Ltd.	5	4¼ — 5¼
14,248	5	5%	Do. Pref. 5%	5	4¾ — 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12¾—12¾
80,000	5	—	North-Eastern Steel Co., Ltd., 4½% 1st Mrt. Db Stk., Red.	100	89 — 93
£250,000	Stk	4½%			
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	5 — 5¼
			Do. 6% Cum. Pref. "A" ..	5	6 — 6¼
50,000	5	3/-	Pease & Partners, Ltd., Ord. ..	10	15¼—15¾
70,000	10	10/-	Do. 4% Perp. Deb. Stock ..	100	99—102
£400,000	Stk	4%	Peebles(Bruce) & Co.,Ld., 6% Cm.P.	5	4¾— 5⅛
20,000	5	3/-	Pooley (Henry) & Son., Ltd., Ord ..	1	11/- —12/-
65,000	1	—	Do. 5½% Cum. Pref.	5	4⅝— 4⅞
13,000	5	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅝ — ¾
230,000	1	—	Rhymney Iron Co., Ltd.	5	2¼ — 2⅜
126,938	5	2/-	Do. New	5	1⅝ — 2
73,062	5	2/-	Do. 5% Mort. Deb., Red. ..	100	102—104
£330,000	—	5½%	Richardsons, Westgarth & Co., Ltd., Ord. 350 001—700.000 ..	1	1 — 1⅛
350,000	1	1/2½	Do. 6% Cum. Pref.	1	1⅜ — 1⅝
£350,000	1	7½	Do. 4½% Perp. Deb. Stock ..	100	98 — 101
£350,000	Stk	4½%	Ruston, Proctor & Co., Ltd... ..	10	10½ — 11
35,000	10	12/-	Scott (Walter), Ltd., Ord.	1	⅛ — ⅛
275 000	1	6d.	Do. 6% Cum. Pref. ..	1	1 — 1⅛
300,000	1	7½d.	Do. 4% Perp. Deb. Stk.	100	94 — 97
£300,000	Stk	4%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red ..	100	94 — 97
£115,300	100	5%	Do. 6% 2nd Mort. Debs., Red.	100	98 —102
£97,900	100	6%	South Durham Steel & Iron, Ltd. Or.	1	1⅜ — 1⅝
250 000	1	1/-	Do. 6% Cum. Pref...	1	⅛ — 1⅜
300,000	1	1/2½	Do. 4½% Per. Deb. Stock	100	95 — 96
£300,000	Stk	4½%	Stephenson (Robert) & Co., Ltd., Or.	10	2¼ — 2⅜
25,000	10	—	Do. 5½% Cum. Pref. ..	10	4¾ — 5¼
25,000	10	5/6	Do. 4% Perp. Deb. Stock	100	80— 83
£250,000	Stk	4%	Stewarts & Lloyds, Ltd., Ord. ..	10	19¼ - 19¾
85,000	10	9/-	Do. 6% Cum. Pref	10	14½ — 15
55,000	10	6/-	Swan, Hunter & Wigham Richardson, Lim. Ord.	1	⅞ — 1⅛
634,732	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1
538,845	1	6d.	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99
£240,000	Stk	4½%	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — ⅝
300,000	1	6d.	Do. 4% Irredeem. 1st Mort. Deb.	100	80 — 84
£200,000	100	4%	Thornycroft (John I.) & Co., Ltd. Or.	1	¾ — 1
£148,500	1	7½d.	Do do. 6% Cum. Pref.	1	1⅛ — 1⅜
£160,000	1	7½d.	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼ — 9¾
10,000	10	5/-	United States Steel Corp. Com. Stk.	$100	37¾ — 38
$508495200	$100	¾	Do. 7% Cum. Pref. Stock	$100	106¾—107½
$366311100	$100	¾	Do. 10.60yr. 5% Skg. Fd. G. Bds.	$1000	99 —101
$16226800	$1000	¾	Vickers, Sons & Maxim, Ltd. Ord..	1	2⅝ — 2¾
3,350,000	1	1/-	Do. 5% Non-Cum. Pref. ..	1	1⅜ - 1⅝
750,000	1	6d.	Do. 5% Non-Cum. Pref. Stock.	106	121 —124
£750,000	Stk	5%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	103 —105
£1,250,000	Stk	4%	Do. 4½% 2nd Mort. Debs., Red.	100	103½-105½
£1,000,000	100	4½%	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	1⅛ — 1⅜
225,000	1	1/-	Do. 6% Cum. Pref. Ord. ..	1	1⅛ — 1⅜
500,000	1	7½	Do. 4% Perpetual Deb. Stock	100	92 — 95
£300,000	Stk	4%	Williams & Robinson, Ord.	5	1½ — 2
66,666	5	—	Do. 6% Cum. Pref.	5	2½ — 3¼
66,666	5	—	Do. 4% 1st Mort. Deb. Stk. Red	100	84 — 89
£246,641	Stk	4%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	10	77—79
£150,000	Stk	4%			

Stocks and Shares marked * are quoted ex-div.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
70,000	1	6d.	Alliance Elec. Co., Ltd., 5% Cum. Pf.	1	¾ - ⅞
125,000	1	7½d.	Arot. Elec. Meter Ltd., 6% Cum. Pf.	1	1⅛ - 1¼
120,000	1	1½	Bell's Asbestos Co., Ltd.	1	1½ - 1⅝
£40,000	5	9d	British Aluminium, 6% Cum Pref.	5	5 — 5¼
£300,000	Stk	5%	Do. 4% 1st Mort. Deb. Stk. Rd.	100	98 — 100
100,000	5	4 -	British Insulated & Helsby Cables Ltd., Ord. ..	5	6⅝ - 7
100,000	5	3/-	Do. 6% Cum. Pref.	5	5⅞ - 6¼
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103 — 105
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd. 4½% 1st Mort. Deb. Stk. Red. ..	100	98 — 100
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	2½ — 2⅝
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	85 — 89
166,731	2	2/-	Brush Elec. Engng. Co., Ltd., Ord..	2	2⅝ - 3
150,000	2	2 4½	Do. 6% Pref.	2	1⅞ - 2
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	94 — 98
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	80 — 84
35,000	5	1/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 12
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅝ - 5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort Deb stk. Red.	100	109 —111
85,000	3	1/6	Crompton & Co., Ltd...	3	1⅝ - 2⅛
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	94 — 99
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	5½ — 6
61,000	5	9/-	Do. 6% Cum. Pref.	5	5½ — 6
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	100 —103
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4 -	Do. 1st Mort. 4% Iree. Deb. Stk.	100	107 110
99,291	5	1 6	Edison and Swan United Electric Light, Ltd. "A" Shares Nos. 1-99,261 ..	3	1⅝ - 1⅞
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2⅛
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	85 — 90
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	92 — 97
112,100	2	1 7½	Electric Construction Co., Ltd. ..	2	2 — 2⅛
31,380	2	2 9½	Do. 7% Cumulative Pref. ..	2	1⅞ - 2⅛
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 — 97
10,248	10	7/6	Evered and Co., Ltd.	10	9 — 11
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 9⅝
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	96 — 100
32,000	5	5/-	Henley's (W. T. Telegraph Works Co., Ltd., Ord.	5	12⅛ — 13⅛
35,000	5	2/3	Do. 4½% Cum. Pref. .. .	5	5⅛ — 5⅜
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	93 —102
7,500	10	—	Parkes, Thos. Ltd.	10	6½ - 7
100,000	1	3½	Scott (Ernest) & Mountain, Ld., Ord.	1	17/3 -17/6
87,500	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	32 — 34
£100	100	4%	Do. 4% Deb. Bonds	100	102— 104

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
120,000	5	3/-	Anglo Argentine Trams Co., Ltd., Or.	5	8¾ — 9⅛
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅛ - 6⅛
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	142 —145
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13⅞ — 14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9¾ — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 — 101
£191,850	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 —102
75,000	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅞ — 1
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	1 — 1⅛
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4 — 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	95 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	124—127
		5%	Pref. Ord. Stock	100	111 -114
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9⅛—10
156,437	10	6/-	Do. 6% Cum. Pref.	10	11 — 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	121 - 123
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98 —100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅜—3⅝
40,500	5	3 -	Do. "A" 6% Cum Pref. ..	5	5⅛ — 5⅜
27,000	5	3/-	Do. "B" do.	5	5 — 5½
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Deb. Stk., Red.	100	98—100
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	103—107

ELECTRIC TRACTION.—*Contd.*

Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices.
150,000	5	5/-	Calcutta Tramways Co., Ltd. .	5	9½—9¾
£350,000	Stk	4½	Do. 4½ 1st Deb. Stk., Red.	100	107 -109
480,000	1	6d.	Cape Electric Tramways, Ltd. .	1	1⅜ - 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞—5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100—103
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101—105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13¾—14½
59,997	10	6/-	Do. 6% Pref...	10	13½ 14
£125,000	Stk	4½	Hastings & Dist. Elec. Trams. Co., Ltd., 4½ Deb. Stock, Red. .	100	101 105
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½ — 2⅝
£150,000	Stk	4½%	Do. 4% Deb. Stock.. ..	100	83 — 88
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10 - 10½
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—103
60,007	1		London Motor Omnibus Co., Ltd., Ord. No. 1—60,007	1	2 — 2½
£79,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	103 107
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅞ - 1
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 1⅛
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	106 —108
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	1⅝— 1⅞
110,928	8	2/9⅜	North Metropolitan Tramways Co..	8	4 — 4¼
£120,000	100	3½%	Do. 3½% Mort. Debs.	100	93 — 98
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	104 107
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	5½ — 6¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¼ — 10½
£220,000	Stk	4½	Do. 4½ Deb Stk., Red	100	101 104
£160,000	Stk		Sunderland Dist. Elec. Trams. Ltd., 5% 1st Mort. Deb. Red... ..	100	95 -99
£275,000	Stk	12 11	Yorkshire (W. Riding) Elec. Trams Co., Ltd., 4½% 1st Deb. Stk., Red.	100	96 -98

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
7,500	10	14 -	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12½ 12⅞
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10½ - 11
7,500	10	6/-	Do. 6% Cum Second Pf. ..	10	11 1⅛
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	107 -109
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5⅝
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	109 —110
27,507	5	4 6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9 — 10
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9 — 9⅝
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9⅝
£288,782	Stk		Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	div. 4 10 10½
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	5¼ — 5½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅛ - 5⅜
£100,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 —105
41,436	5	2/8	Chelsea Elec. Sply. Co., Ltd., Ord.	5	5 — 6
£120,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	110 —112
70,000	10	7/-	City of London El. Lghtg. Co., Ltd., O.	10	11¼ 11⅝
40,000	10	6/-	Do. 6% Cum. Pref.	10	13¾ 14⅛
£100,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	124 —125
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	104 —106
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	8⅛ - 8⅝
30,000	10	6/-	Do. 6% Cum. Pref.	10	12⅛ - 12⅝
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	112 - 114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5⅛ - 5⅜
70,000	5	8/-	Do. 6% Cum. Pref.	5	5⅛ - 5⅜
£300,000	Stk	4½%	Do. 4½% 1st Mort Deb. Stk. Reg	100	108 - 111
£[illegible],000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90
12,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5⅛ — 5⅜
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9 — 10
1[illegible],000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	9½ — 9⅝
£[illegible],000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅞ — 1
[illegible],000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	10⅛ - 10⅜

Stocks and Shares marked [illegible] ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up.	Closing Prices.
£135,000	Stk	4 ..	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	98 —101
111,000	3	1 9	London Elec. Supply Corp., Ld., Ord.	3	1½ - 2½
60,000	5	3/-	Do. 6% Pref.	5	4¾ — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 -102
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld ,Or.	10	9½ — 10¼
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97— 99
£250 000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	101—103%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ — 15½
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 —100
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6⅜ — 6¾
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	100 —102
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —103
40,000	5	5/	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13 —14
20,000	5	3/6	Do. 7% Pref...	5	8 — 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2 — 2½
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	76 — 86
65,000	5	4/-	South London Elec. Sup. Co., Ltd, O.	5	3½ — 3¾
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 — 15/16
50,000	1	8½d.	Do. 7% Cum. Pref.	1	1 1/16 — 1 1/8
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4½ — 4¾
90,000	5	2/6	Do. 5% Cum Pref.	5	5 — 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104 —106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	11½ — 12½
28,151	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 6¼

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Divi dend.	Name	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	3½ — 4¼
£763,580	Stk	14/-	Anglo-American Tel. Co. Ltd., Ord.	100	62 — 64
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	109½—110½
£3,118,210	Stk	2 -	Do. Deferred Ordinary ..	100	16⅞ — 17⅛
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7⅝ — 7⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	— — —
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96 — 98
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8⅞ — 9¼
6,000	10	10/-	Do. 10% Preference	10	17 —18
6,000	5	2/- 5/	Direct Spanish Telegraph Co., Ord. 10% Cum. Preference	5 5	3⅛ — 3⅜ 9¼ — 9½
£30,000	50	4½%	Do. 4½% Debs...	50	100-103%
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	13½—14½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100½—102½
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	103—102 %
800,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14½—15
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 — 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	144 - 147
£2,000,000	Stk	17/6	Do. 8% Pref.	100	89½—91½
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	105 —108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 — 37
£58.700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100½—102½
,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	37½—39½
72.680	1	9d.	Monte Video Telephone Co., Ltd., O.	1	⅝ — 1
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	110½—111½
£1,966 667	Stk	5%	Do. Deferred	100	108 — 110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅛ — 5¼
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	97½— 99½
£6?9, 93	Stk	4%	Do. 4% do. do. ..	100	104 —106
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1⅛ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 1/16 — 1 1/8
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	100—103
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½ — 8
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7½ — 8
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	111 —113
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	10—10½*
£30,008	2½		West Coast of America, Ltd. ..	2½	⅝ - 11/16
150,000	100	4%	Do 4% Deb. Guar. by West. Tel.	100	100—102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up.	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅛— ¼
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼ — 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6½ 7½
£80,000	100	5 ..	Do. 5% Deb.	100	101 —104
207,930	10	9/-	Western Telegraph Co., Ltd. ..	10	14 —14½
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	102 —104
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Divi dend	Name	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9¼— 9⅝
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	98 —100
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6½— 6¾
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	— —
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1 60,000..	20	13 - 13½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5¼— 6½
£461,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102—104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9½	Do. Non-Cum. 6% Pref.	8	8¼— 9
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2 — 2½
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	88 — 91
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	5½— 6
20,349	10	5/-	Orient Stm. Nav. Co.. Ltd., Pref. Nos. 1-20,349 ..	10	7 7¼
£103,100	Stk	4%	Do. 4% Deb. Stk., Red. ..	100	89—92
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	127—130
£1,160,000	Stk	19%	Do. do Deferred ..	100	241—247
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	45— 47
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5½
39,075	5	2/6	Do. "B" Ord...	5	3¾— 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 9¼
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¾— 11¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	101 —103

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares	Last Divi dend.	Name	Paid up.	Closing Prices
60,000	1	9½d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 —1⅛
£750,000	Stk	5	General Hydraulic Power Co., Ltd.	100	124 —129
12,500	10	10/	Oakey (John) and Sons, Ltd., Ord..	10	26 — 28
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6¾d.	Power Gas Corp., Ltd., Ord., Nos. 66,463 250	15/-	½ — ⅝
66,462	1	8½d.	Do. do. Nos. 1 66,462	1	⅜— ½
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ —1¼
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛ —1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

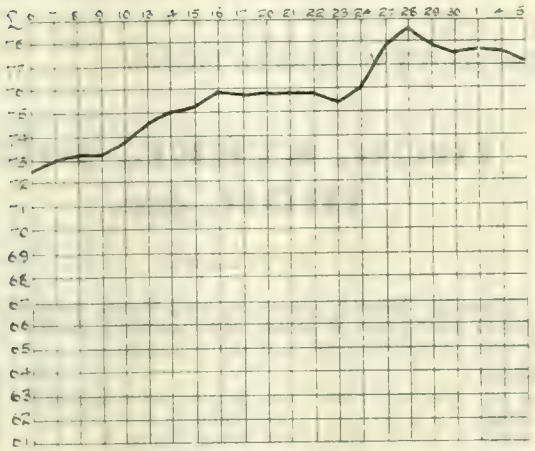
Present Amount Subscribed	Shares.	Last Divi dend.	Name	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	25 — 27
8,739	10	3/-	Do. Second Issue 1-8,739....	4	9¼ 9¾
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14⅛
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1 29,861 & 49,751-50,000	7	10¼— 10½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4⅛ — 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2⅛ — 2⅜
4,150	10	5%	Do. do.	10	10⅜ - 10⅝
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/6 44/6*
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/ —25/
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/ —29/*
20,000	20	20/	Midland Rail.-Car & Wagon, Ld., 1-20,000	10	20 — 21

Stocks and Shares marked * are quoted ex-dividend.

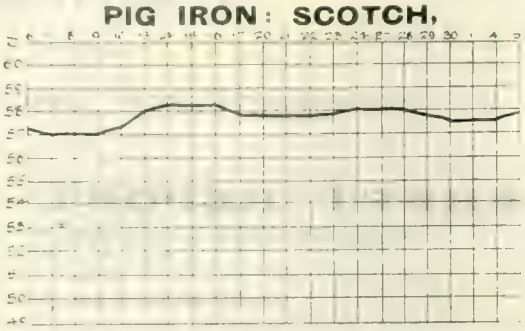
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM NOVEMBER 6TH TO DECEMBER 5TH, 1905.

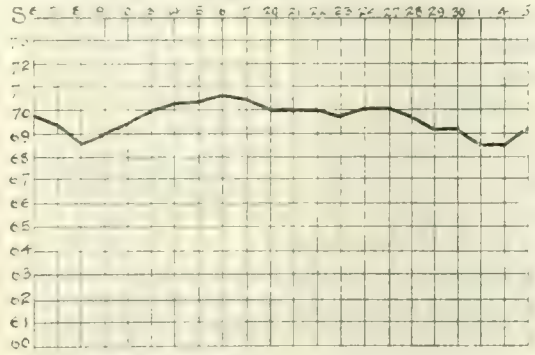
COPPER.



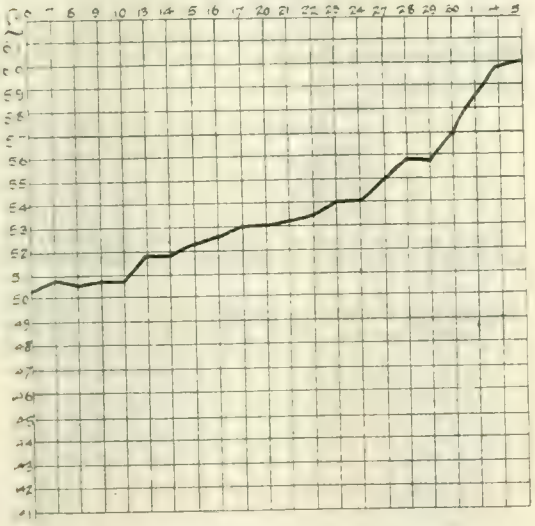
PIG IRON: SCOTCH.



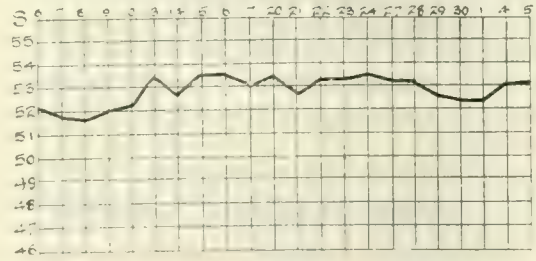
HEMATITE.



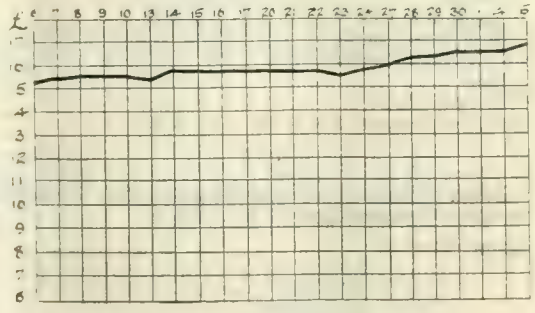
TIN.



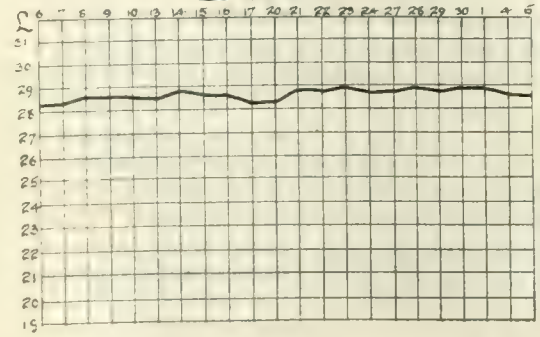
CLEVELAND.



ENGLISH LEAD.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, December 6th, 1905.

THE price of copper continues to advance, and this quite apart from speculative transactions, for the rise is absolutely due to the growth of consumption and the disappearance of reserved stocks. Indeed, it is not too much to say, that, unless the output of copper increases very rapidly, we are face to face with prospect of a really serious dearth of the metal. At one time during the past week, the price of copper touched £79 and even three months metal found buyers up to £78 per ton. This pace, however, was a little too fast, and heavy realising brought about a reaction in quotations. The latest prices are £77 cash, and £76 12s. 6d. three months.

Tin has also been a strong market, a large business having been transacted at improving quotations. In view of the Banca sale last week dealers did their utmost to hold quotations down, but this policy proved ineffective, the competition of buyers at the Banca auction being exceedingly keen. The price which had to be paid for Banca was over £160 per ton, and a fresh rise in quotations is extremely probable. The closing price to-day is £160 17s. 6d. cash metal, with three months quoted at £158.

Lead is a firm market, and on large buying for forward delivery, the price of soft foreign prompt has advanced to £16 12s. 6d., which is the highest price for five years past. Spelter has ruled strong until the last day or two, since when a lower tone has been apparent. At one time Ordinaries for near dates fetched £28 15s., but prompts were done to-day at £28 10s. There is considerable activity in galvanised iron.

In distinction to other sections, pig-iron has relapsed in price. This change in the tone of the market is attributable to several causes, the principal being the disappointment caused by the further increase in public stocks, which in its turn induced realisation by tired holders. The satisfactory feature of the position is that the weak bull element appeared to have been to a great extent weeded out, and holdings are now in stronger hands. For this reason the outlook is somewhat more promising for the renewal of the upward movement. The general trade outlook remains good and closing prices to-night are Cleveland, 53s.; Scotch, 59s. 7d.; Hematite, 69s. 10d.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	8	2	6
	,, ,, ,, Land ,, ,, ...	8	2	6
STEEL	,, Steel Bars Boiler Quality	8	5	0
DALZELL	Siemens' Steel Plates, Ship Quality Plates.....	7	2	6
	,, ,, Bars ,, ,, ...	7	15	0
STEEL	,, ,, Angles.....	6	15	0

Manufactured Iron:				
Bars—Dalzell		7	2	6
,, Best		7	12	6
,, ,, Horseshoe		7	12	6
,, Angle		7	2	6
,, Best Angle		7	12	6
,, Best Best		8	2	6
,, Extra Best		8	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

Malleable Common Bars:	£	s.	d.	
Dalzell, per ton	7	2	6	5 per cent.
Govan	6	10	0	,,
North British .	6	10	0	,,
Drumpellier	6	7	6	,,
Waverley .	6	10	0	,,
Crown .	6	5	0	,,
Dundyvan	6	5	0	,,
Muirkirk	6	5	0	,,
Rochsolloch	6	5	0	,,
Phœnix	7	5	0	,,
Coatbridge	7	2	6	,,
Coats	6	5	0	,,
Angle Iron				,,
Steel Plates—ship				,,
,, Boiler Plates				,,
Rails.				,,
Railway Chairs				,,

G.M.B. at Glasgow, No. 1, 64s.; No. 3, 61s.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote:—

	£	s	d.
Bars—Phœnix	7	5	0
,, Best	7	15	0
,, Best Best	8	5	0
,, Extra Best.....	8	15	0
,, Best Horse Shoe	7	15	0
,, Extra B.H.S.	8	15	0
,, Extra Best Cable	9	5	0
,, Rivet	7	5	0
,, Best Scrap Rivet	8	5	0

	£	s.	d.
Angles—Phœnix	7	5	0
,, Best	7	15	0
,, Extra Best	8	5	0
Gas Tube Hoops—Phœnix Best	7	15	0
Plates—Phœnix	—		
,, Best Boiler	8	10	0
,, Best Best Boiler	9	0	0
,, Extra Best Boiler	10	0	0
Boiler Tube Strips—Phœnix	9	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	16	0	3	6	0
Gartsherrie ,,	3	8	6	3	3	6
Summerlee ,,	3	11	0	3	6	0
Carnbroe ,,	3	5	0	3	2	0
Langloan ,,	3	10	0	3	5	0
Calder ,,	3	7	6	3	2	6
Clyde ,,	3	8	0	3	3	0
Glengarnock, f.o.b. Ardrossan	3	8	0	3	3	0
Eglinton ,, ,,	3	2	6	3	0	0
Dalmellington, ,, Ayr				3	0	0
Shotts ,, Leith	3	7	6	3	2	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W Bars	7	5	0
W.W. Best Bars	7	12	6
W.W. Best Best	8	0	0
W.W. Best Best Best	8	7	6
W.W. Best Shoe	7	15	0
Thornaby	8	15	0
Thornaby Best	9	5	0
Thornaby Best Best	10	5	0
Whitwell Special Admiralty Cable	10	15	0
Special Chain Iron	9	15	0
Tube and Nail Strip iron net cash	7	5	0
W.W. Angle Iron	7	7	6
W.W. Best Angle Iron	7	15	0
Tee Iron, to 8-inches United	8	5	0

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd., Dallam and Bewsey Forges, Warrington, quote as follows:—

		Iron. £	s.	d.	Steel. £	s.	d.
	Bars	7	5	0	7	10	0
	Angles	7	15	0	8	0	0
(BNF)	Tees	8	5	0	8	10	0
	Hoops	7	10	0	8	0	0
W.I.W	Sheets	8	15	0	9	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

Lots under 10 cwts. of a size 10s. per ton extra.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
Black Sheets						
"Vale"	10	10	0	11	0	0
"Shield"	11	0	0	12	0	0
"Severn"	12	0	0	13	0	0
"Baldwin Wilden B."	13	0	0	14	0	0
Charcoal	17	0	0	18	0	0
Best Charcoal	19	0	0	20	0	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	14	0	0	15	0	0
S.V. Lead	15	10	0	16	10	0
No. 3 Terne	15	10	0	16	10	0
S.V. Terne	17	0	0	18	0	0

Tinned Sheets:	Singles 24 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in. per ton. £	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	13	7	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	15	10	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	11	7	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	7	5	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ to 4 in. rounds and squares)	7	15	0	,,
Angles	7	10	0	,,
,, Best	8	0	0	,,
Tees	7	15	0	,,
,, Best	8	5	0	,,
Best Shoe Iron	8	15	0	,,
,, Rivet Iron	8	15	0	,,
,, Best Rivet (Special)	10	0	0	,,
,, Cable	10	0	0	,,
,, Screwing	9	0	0	,,

	£	s.	d.	
Best T...	8	15	0	per ton.
.. Lo...	9	0	0	,,
Best Best ...	10	0	0	,,
Tri...	11	0	0	,,
Pl...	8	5	0	,,
Best Plates ...	8	15	0	,,
.. Boiler Plates ...	9	5	0	,,
.. Best Boiler Plates ...	10	5	0	,,
Treble Best Boiler Plates ...	12	15	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

42½ per cent. off 1 inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. points.

37½ per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. points.

37½ per cent. off all sharp-pointed nails.

Delivered in lots of 1 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 10/6 per cwt.
4 cwt. lots and upwards 10/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch to 6-inch basis—

2 tons 9/3 per cwt.
4 cwt. lots 9/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £8 per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18 by 14 124s. 110 lb. "BV" ...	0	13	3
C 20 by 10 225s. 155 ,, "Jumbo" ...	0	18	9
C 20 by 14 112s. 108 ,, "Lydbrook" ...	0	13	0
C 28 by 20 112s. 216 ,, "Lydbrook" ...	1	6	3

Charcoal Tinplates :

C 20 ... 14 112s. 108 lb "Allaway" ...	0	13	9	

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered ... and ANTWERP for approved quantities.

Steel :	£	s.	d.	
Blooms ... at	4	2	0	per ton.
Billets ... at	4	4	0	,,
Sheet Bars ... at	4	6	0	,,

Finished Steel :

Bars ... at	5	15	0	per ton.
Angles ... at	5	16	0	,,
Tees ... at	5	19	0	,,
Joists ... at	5	0	0	,,
Fencing Standards ... at	5	15	0	,,
Shoeing Bars ... at	5	19	0	,,
T-ir P... at	5	19	0	,,
Hoop ... at	6	3	0	,,
Hoop ... at	5	10	0	,,
Light ... at	5	10	0	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin :	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. ... Dis. 1¼ ,, & 1½ ...	162	10	0	to	163	0	0	per ton
English Bars, f.o.b. ... Dis. 1¼ ,, & 1½ ...	163	10	0	to	164	0	0	,,
Straits G.M.B., cash Warehouse, Net	160	0	0	to	160	5	0	,,
Straits G.M.B., 3 months, Warehouse, Net ...	157	5	0	to	157	10	0	,,
Australian, Mt. Bischoff, Warehouse, Net	160	10	0	to	160	15	0	,,

COPPER.

Copper :	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net ...	77	2	6	to	77	5	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	76	15	0	to	76	17	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	84	0	0	to	84	10	0	,,
English, Best Select, Warehouse Net ...	84	10	0	to	85	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½% ...	90	0	0	to	91	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	86	0	0	to	87	0	0	,,
Electro, Warehouse, Net .	84	5	0	to	84	10	0	,,
Ore, ex ship ...	0	13	9	to	0	14	9	per unit.
Regulus, Matte and Precipitate, ex ship,	0	14	9	to	0	15	3	,,

YELLOW METAL.

Yellow Metal :	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½% ...	0	0	7½	per lb
Sheathing ,, ,, ...	0	0	7¼	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net ...	28	10	0	to	28	15	0	per ton.
Blende of 50 %, Net ...	8	0	0	to	8	7	6	,,
Calamine, Net	8	9	0	to	8	10	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½ ...	16	15	0	to	17	0	0	per ton.
Spanish, ex ship, Dis. 2½%	16	10	0	to	16	12	6	,,
Lead Ore of 70 %, Net...	8	0	0	to	8	10	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½	53	0	0	to	54	0	0	per ton
Ore, 50 %, ex ship, Dis. 2½%	12	10	0	to	15	0	0	,,
Crude, ex ship, Dis. 2½ %...	30	0	0	to	32	0	0	,,

QUICKSILVER.

	£	s.	d	
Spanish, 75 lb., Warehouse, Net...	7	5	0	per flask
Italian ,, ,, ,, ...	7	2	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage. —

Upper Main Seam.	s.	d.
Main Coal	6	6
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston, quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	3
Large Nuts (1½ to 3½)	9	0
Small Nuts (¾ to 1½)	6	0
Pens (⅝ to ¾)	5	0
Rough Slack	4	0
Slack	3	6
Smudge	2	0

Rutland Coal:		
Brights, 4 to 8	7	6
Large Nuts (2 to 4)	7	0
Slack	3	6
Hand picked Hards	7	6
Hard Cobbles	6	3

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:		
STEAM	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.		
HIGH HEATER for Ashless House Coals.		
London Brights, 4 to 8 in. cube	11	0
Bright Cobbles (Hand Picked)	10	6
Large Nuts, 2 to 4 in. cube	10	0
Small Nuts, 1 to 2 in. cube	6	3
Pea Nuts, ⅝ to 1 in. cube	5	6
STEAM — TOP HARD.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10½	,,
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
Grey	11	15	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	15	0	per ton.
Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	15	0	,,
Arsenic: Best White Powdered net	15	0	0	,,
Bleaching Powder, 35% ,,	4	7	6	,,
Borax: British Refined Crystal ,,	13	0	0	,,
Coal Tar Products:				
Benzole, 50/90% ,,	0	0	8½	per gal
,, 90% ,,	0	0	9	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6	per lb.
,, ,, ,, 39/40° C. ,,	0	0	6½	,,
,, ,, Liquid, 97/99% ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	10	,,
Creosote, ordinary good liquid ,,	0	0	1½	,,
Naphtha, Crude, 20% at 120° C. ,,	0	0	4	,,
,, Solvent, 90% at 160° C. f.o.b. ,,	0	1	0	,,
,, ,, 95% at 160° C. ,, ,,	0	1	0½	,,
,, ,, 90% at 190° C. ,, ,,	0	1	1½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	1	1½	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	2½	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	12	6	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	18	6	,,
Cake ,,	1	1	6	,,
Copper: Sulphate	24	10	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	24	10	0	,,
,, ,, Grey	22	15	0	,,
,, ,, Brown at Manchester	17	15	0	,,
Nitrate	25	10	0	,,
Litharge, Flake	17	5	0	,,
,, Powder	17	15	0	,,
Red Lead, Genuine, c.i.f London less 5%	16	15	0	,,
White ,, Dry ,,	18	0	0	,,
Naphtha (Wood). Miscible, 60 o.p.	0	2	4	per gal.
Solvent	0	2	7	,,
Potash: Bichromate delivered England	0	0	3	per lb.
Carbonate, 90/92% c.i.f Hull	17	15	0	per ton.
Caustic, 75/80% ,, ,,	19	5	0	,,
Chlorate net	0	0	3¼	per lb.
Montreal in Store, Liverpool	31	10	0	per ton.
Prussiate Yellow net	0	0	4½	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, Refined ... ,,	6	5	0	,,
	,, Carbonated, 48 % ... ,,	5	10	0	,,
	,, ,, 58 %, (Ammonia Alkali) ... net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % ... net	6	10	0	,,
	Caustic, White, 77 % ... ,,	10	12	6	,,
	,, ,, 70 % ... ,,	9	12	6	,,
	,, ,, 60 % ... ,,	8	12	6	,,
	,, Cream, 60 % ... ,,	8	10	0	,,
	Crystals, in bags ...	3	0	0	,,
	,, barrels ...	3	7	6	,,
	Acetate ... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs ...	6	15	0	,,
	Bichromate ... delivered England ...	0	0	2¼	per lb.
	Chlorate ... net	0	0	3¼	per lb.
	Nitrate ... ex quay Liverpool, ... ,,	11	0	0	per ton.
	Phosphate ...	9	5	0	,,
	Prussiate ... net	0	0	3 7/16	per lb.
	Silicate, Solution, 140° Tw. ...	4	10	0	per ton.
	Sulphate (Glauber Salts) ...	1	10	0	,,
	,, (Saltcake, 95%) ...	1	15	0	,,
Sulphur:	Recovered ...	4	15	0	,,
	Roll ...	6	15	0	,,
	Flowers ...	7	10	0	,,
Zinc:	Sulphate ...	6	15	0	,,
Shellac:	Standard TN orange spot ...	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92% ...	3	10	0	per ton.
	Sulphate, No. 1, White ...	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports ...	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.				per metallic unit.
Ochre:	French JC ... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF ...	5	10	0	,,
Talc:	(French Chalk) ... c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	13	3	to	0	14	3	per unit.
Regulus, 45 to 55% ...	0	14	3	to	0	14	9	,,
Precipitate, 65 to 80% ...	0	14	4½	to	0	14	10½	,,
Tin Ores, 70 % ...	95	0	0	to	97	0	0	per ton.
Lead Ore, 70% ...					8	0	0	,,
Blende, 50% ...					8	6	6	,,
Calamine ...					8	9	0	,,
Antimony, Star Regulus	48	0	0	to	50	0	0	,,
,, Ore 50% ...	12	10	0	to	15	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman ...	7	6	per ton.
Do. ...	,,	Cartagena ...	7	10	,,
Special ...	,,	Porman ...			
Do. do.	,,	Cartagena ...	8	2	,,
Extra quality do.	,,	,, ...	8	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	...	11	0	,,
S.P. Campanil Coast	,,	...	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine ...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine ...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine ...	,,	0	1	3		0	1	8
Quebec Red Pine ...	,,	0	1	6		0	2	3
Quebec Oak, 1st quality ...	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash ...	,,	0	1	6		0	2	3
Elm ...	,,	0	3	3		0	4	0
Hickory ...	,,	0	2	0		0	2	6
Quebec Birch ...	,,	0	1	6		0	2	3
St. John Birch ...	,,	0	1	6		0	2	0
Birch Planks ...	,,	0	0	9		0	0	11
Spruce Spars ...	,,	0	0	10		0	1	0

Deals.

1st quality Quebec Pine ...	per std.	22	10	0	to	32	10	0
2nd do. do. ...	,,	17	0	0		22	0	0
3rd do. do. ...	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce ...	,,	7	10	0		7	15	0
Nova Scotia Spruce ...	,,	7	7	6		7	12	6
Spruce Boards ...	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn ...	per cub. ft.	0	1	4	to	0	1	8
Sawn ...	,,	0	1	0		0	1	6
Planks, Stowage ...	,,	0	0	10		0	1	0
Boards, Prime ...	per std.	12	10	0		16	0	0
Oak Timber ...	per cub. ft.	0	1	6		0	2	6
Oak Planks ...	,,	0	1	6		0	2	1
East India Teak ...	per load	12	0	0		19	0	0
Greenheart ...	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood ...	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown ...	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling ...	,,	0	1	9		0	1	11
Stettin ...	,,	0	1	9		0	1	11
Swedish ...	,,	0	1	0		0	1	3
Riga Whitewood ...	,,	0	1	0		0	1	3
Norway Mining Timber ...	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak ...	,,	0	2	6		0	3	0
Norway Spars ...	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality ...	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality ...	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality ...	,,	10	10	0		12	10	0
St. Petersburg, 1st quality ...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle ...	,,	11	10	0		16	0	0
Wyburg ...	,,	11	0	0		12	10	0
Uleaborg ...	,,	10	0	0		12	10	0
Gothenburg ...	,,	11	0	0		16	0	0

SELECTED PATENTS.

NEW PATENTS APPLIED FOR.

(November 20th—25th).

ELECTRICAL.

[illegible] J. H. BASTIANS, Kenley, Surrey.—Locking device and electric coupling for arc lamps and the like.

23,889. H. E. NEWTON, London.—Improvements relating to automatically cutting off the current from electrically heated furnaces, stoves, or other apparatus at any desired temperature.

23,894. THE BRITISH THOMSON-HOUSTON COMPANY, LTD., and J. M. WALLACE, London.—Improvements in and relating to electric switches.

23,934. A. J. BOULT, London.—Improvements in or relating to electrical distribution systems.

23,978. E. E. LEHWESS and L. K. CLARK London.—Improvements in power transmitting devices.

23,997. SIEMENS BROS. AND CO., LTD., and G. S. GRIMSTON, London.—Improvements in electric tele[illegible]

[illegible] THE BRITISH THOMSON-HOUSTON COMPANY, LTD, London.—Improvements in means for controlling self exciting generators.

24,025. THE BRITISH THOMSON-HOUSTON COMPANY, LTD., London.—Improvements in and relating to vapour electric apparatus.

24,106. R. BRAUN, London. Improvements in operating rotating apparatus by means of single phase commutator electric motors supplied for polyphase circuits.

24,139. H. GUILLOU, London.—Improvements in magneto or dynamo electric machines.

24,141. The Hon. C. A. PARSONS and A. H. LAW, London.—Improvements in dynamo electric machines.

24,183. F. E. IMESON, York.—Improved controller finger contact for electrical work.

24,184. J. E. NEWTON, Bolton.—An automatic life guard or cut-out for overhead electric wires.

24,187. T. H. LARGE, Glasgow.—Improvements in apparatus for the control of electro-magnetic power hammers, drop stamps, presses, and the like.

24,197. W. N. STEWART, London.—Improvements in or connected with the control of electric motors used in connection with secondary or storage batteries.

24,213. L. G. LORING, London.—Improvements in make and break apparatus suitable for induction coils.

24,235. THE BRITISH THOMSON-HOUSTON COMPANY, LTD., London.—Improvements in electric motor-controlling devices. (The General Electric Company, United States).

24,236. THE BRITISH THOMSON-HOUSTON COMPANY, LTD., London.—Improvements in and relating to electric switches. (The General Electric Company, United States.)

24,268. H. J. PEDDIE, Edinburgh.—Improvements in the section and form of conduit in the method of laying it in connection with tramway rails and placing within it an electric conductor and in the manner of applying a brush or pulley from a car to the said electric conductor.

24,302. J. M. TOURTEL, London.—Improvements in mechanism for automatically actuating electric switches or contacts or apparatus for regulating the supply of electricity at different rates or for similar purposes.

24,316. S. JEVONS, Birmingham.—Improvements in electrical generators or motors.

24,325. A. J. BOULT London.—Improvements in or relating to electric conductors. (Harry E. Knight, United States.)

[illegible] A. L. PARSONS and A. P. PYNE, London.—Improvements in junction boxes and similar apparatus for the connection of electric cables or the like.

24,383. J. A. HIRST and P. S. BROOK, Chester.—Improvements in electric switches.

24,403. THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, LTD., London.—Improvements in apparatus for controlling electric circuits. (The Westinghouse Electric and Manufacturing Company, United States.)

24,421. L. TORDA, London.—Improvements in dynamo-electric machines.

NAVAL AND MARINE.

23,908. A. C. DAVEY, London.—Improvements in fog horns and fog whistles or signals.

23,915. J.-P. SERVE, Liverpool.—Improvements in the hulls of armoured vessels.

23,930. F. KOPECKY, London.—A new or improved torpedo.

23,968. R. BAIRD, Govan.—Improvements in screw propellers.

24,084. P. MICHIE, Glasgow.—Means for indicating the position of submerged vessels and for raising the same.

24,154. W. CURTIS and W. F. GOREHAM, Hull.—Improvements in shackles for ships' cables and chains.

24,155. R. HANDCOCK, Gateshead.—Weldless steel coupling link for chains.

24,178. J. EAGLESHAM, London.—Improvements in ships' telegraphs and like instruments.

[illegible] V. J. DUBOLON, London.—Improvements in and relating to manoeuvring apparatus for vessels. (Soc. Anon. John Cockerill, Belgium.)

24,246. J. BONNICART, Paris.—Improvements in and relating to fog horns. (Louis Auguste Desponts and Pierre Achille Godefroy, France.)

24,285. W. HOUSTON, London.—Carrier screws for ships, boats, and the like, also for aerial vessels.

24,409. L. GAUTREAU, T. GAUTREAU, and J. B. E. DELSUC, London.—Improvements in screw propellers.

MACHINE TOOLS.

[illegible] W. L. H. LEWERS, London.—Improvements in and relating to portable pneumatic hammers.

24,237. G. A. WATSON and F. S. FREESTONE, Manchester.—Improvements in or relating to drilling or boring machines.

24,260. R. WALMSLEY, G. A. RYDER, and E. HOLLINGS, Liverpool.—Improvements in machines for forming blanks for nuts or like articles.

[illegible] J. LEEMING, jun., and A. GREENHALGH, Manchester.—Improvements in hydraulic presses.

IRON AND STEEL.

23,932. H. SACK, London.—Improvements in universal rolling mills for girders.

24,031. E. BIER and A. HOFFMANN, London.—Process for producing solid drawn tubes.

24,046. T. EDWARD, Glasgow.—Improvements in plate bending and straightening machines.

METALLURGICAL.

[illegible] H. H. LAKE, London.—Improvements in the art of producing metallic iridium. (Herschel Clifford Parker, United States).

24,036. D. R. JENKINS, London.—Improvements in [illegible] with machinery or apparatus employed in coating metal plates with tin, terne or other metal or alloy.

24,068. R. P. CHARLES, London.—Improvements [illegible] melting.

24,124. W. S. SIMPSON, London.—Improved process for treating and annealing metals.

24,129. W. VAN DER HEYDEN, London.—Improvements in the reduction of metalliferous ores.

24,238. N. M. OGLE, London.—An improved method of treating complex ores (sulphides) containing copper zinc and lead.

BOILERS, ETC.

23,885. W. G. POTTER, London.—Improvements relating to steam generating boilers and economisers, superheaters and the like.

23,899. W. A. MOFFATT, London.—Improvements in gravity boiler feed.

24,127. D. M. BROUGHTON, London.—Improvements in steam boilers.

24,354. H. M. PORON, London.—Improvements in or applicable to steam boilers.

24,415. G. BRANDSTETTER and R. FREUND, London.—Improvements in apparatus for automatically feeding boilers.

MINING.

[illegible] H. B. HANNAY London.—A new or improved process for the treatment of galena for the production of white lead and the extraction of silver.

23,879. H. L. SULMAN, H. F. KIRKPATRICK-PICARD, and J. BALLOT, London.—Improvements in or relating to ore concentration.

23,887. W. H. BAXTER, Leeds.—Improvements in or relating to elevators employed for raising stone, ore coal and other materials.

23,895. O. SILBERRAD, London.—Improvements in explosives.

23,959. G. MACKAY, Durham.—Improvements in sliding bottoms for coal tubs or wagons and means of actuating same.

23,977. R. W. E. MACIVOR and M. FRADD, London, —Improvements in the treatment of sulphide ores containing zinc.

24,002. H. WALKER, London.—Improvements appertaining to the destruction of noxious or piosonous fumes or gases in blasting operations in mines and the like.

24,165. J. LAWSON, Snalwell, Durham.—Burner for miners' safety lamps.

24,315. J. INGHAM, J. INGHAM, and G. INGHAM London.—Improvements in the construction of colliery tubs and like vehicles.

24,351. G. D. WARREN, London.—Improvements in rock drills.

24,368. J. W. WHITE, Liverpool.—An improvement in connection with colliery winding gear and like gears.

PUMPS, ETC.

23,866. S. TAYLOR and J. BERRY, Radcliffe, Man[illegible]

23,923. J. T. ROSSITER, London.—Improvements in centrifugal pumps.

24,065. N. TUCKER, Birmingham.—An improved pump.

24,356. J. H. COUPE, London.—Improvements in and connected with steam driven pumps.

24,359. C. P. MCMULLEN and W. E. NYE, London. —Improvements in governors for pumping engines.

TURBINES.

[illegible] B. G. COBB and W. F. COBB, London.—A turbine engine driven by the internal explosion of certain gases.

23,922. W. CHILTON and THE BRUSH ELECTRICAL ENGINEERING COMPANY, LTD., London.—Improvements in or relating to fluid pressure turbines.

24,205. W. CHILTON and THE BRUSH ELECTRICAL ENGINEERING COMPANY, LTD., London.—Improvements in steam and other fluid pressure turbines.

24,261. P. D. IONIDES, Glasgow.—Improvements in or connected with clearance indicators for use in turbines.

24,320. W. R. SMITH, London.—Apparatus for driving elastic fluid turbines by means of compressed air.

24,336. H. S. LOUD, London.—Improvements in elastic fluid turbines.

COMPRESSORS, ETC.

23,976. THE PHOENIX DYNAMO MANUFACTURING COMPANY, LTD., and R. POHL, London.—Improvements relating to combined electric motors and air compressors.

23,989. H. H. LAKE, London.—Improvements in fluid compressors. (Ingersoll-Rand Company, United States).

23,992. H. H. LAKE, London.—Improvements in air-compressors. (Ingersoll-Rand Company, United States).

23,994. H. H. LAKE, London.—Improvements in air compressors. (Ingersoll-Rand Company, United States).

24,272. J. GILL, London.—Improvements in apparatus for compressing air or other elastic fluid for the production of motive power and other purposes.

WHEELS.

23,864. C. W. HARVEY, Norfolk.—An improved wheel for motor cars, wagons and other heavy vehicles.

23,868. J. PARTINGTON, Keighley, Yorks.—Improvements in and relating to resilient wheels.

23,917. R. H. DAVIS, London.—Improvement in elastic or spring wheels for vehicles.

23,988. E. WIGGLESWORTH, London.—Improvements in flexible wheels.

24,190. C. P. MEADOWS and D. E. KNOWLESS Chiswick, Middlesex.—Improvements in or relating to the rims of wheels for road vehicles and the like.

24,209. L. MORETTI, London.—Improvements in or relating to spring wheels for vehicles.

24,237. W. H. MELVIN and A. MANN, London.—Improvements in wheels.

24,329. M. LAMY, London.—Improvements in or relating to peripheral structures for wheels.

INTERNAL COMBUSTION ENGINES.

[illegible] A. J. BENNETT and W. J. DAVIS, London. —Improvements in multiple cylinder internal combustion engines.

24,276. A. CAMPBELL, Halifax.—Improvements in internal combustion engines.

24,439. A. H. MALTMAN, London.—Improvement, in internal combustion engines.

GAS MANUFACTURE.

[illegible] apparatus for the manufacture of air gas.

24,022. S. J. Fowler, London.—Improvements in arrangements of stand pipes and connections for gas retorts.

24,433. G. Marconnett, London.—Improvements in and relating to gas generators or other apparatus producing combustible gases.

MISCELLANEOUS.

[illegible] in multiple expansion rotary engines.

[illegible] Improved means and apparatus for spraying, colouring or whitewashing railway-tubes, tunnels and the like.

24,355. J. Temperley, J. R. Temperley, and W. Alexander, London.—Improvements in apparatus for raising lowering and conveying or transporting loads.

[illegible] in and connected with aerial or ropeway conveyors.

24,388. A. Goldsmith and G. Francombe, Bristol. —Improved automatic sprinkler and fire alarm.

24,408. Belliss and Morcom, Ltd. and R. McGregor, London.—Improved fluid pressure relief valve.

24,407. H. Japp, London.—Improvements in the manufacture and production of segments for tunnel linings.

23,859. E. Tilston, Manchester.—Improvements in lubricating bearings and other frictional surfaces.

24,207. C. C. Wakefield, London.—Improvements in or relating to lubricators.

23,998. E. T. Greenfield, London.—Improvements in machines for constructing flexible metal tubes and armouring flexible hose or other tubes.

24,012. F. C. Ihlee, London.—Improvements in or relating to reciprocating engines suitable for road vehicles and other purposes.

24,042. W. W. Hewitt and W. F. Goreham, Dartford, Kent.—Improvements in machines for testing cement and other like substances.

24,059. J. Haworth, Manchester.—Improved packing for steam, water, and other joints.

24,116. H. Goehtz, London.—Improvements relating to stoking apparatus.

24,252. E. Brunner, Manchester.—Improvements in furnaces.

24,289. W. R. Comings, Wimbledon Park, Surrey. —Improvements in collapsible dredger top boxes.

RECENT SPECIFICATION.

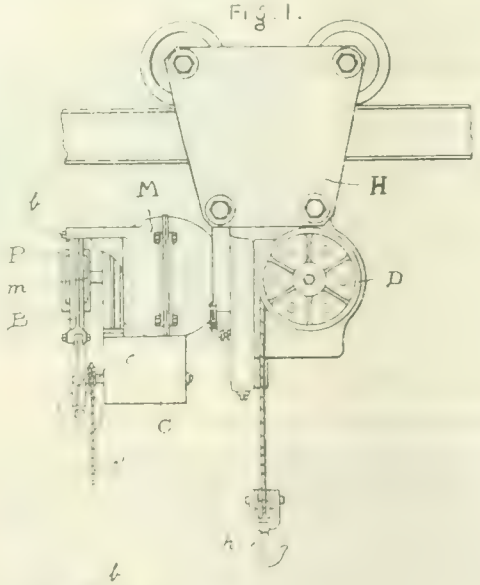
IMPROVEMENTS IN BRAKES FOR HOISTS AND THE LIKE.

The British Thomson-Houston Company, Ltd. (communication from the General Electric Co.) —Accepted November 2nd, 1905.—This invention relates to electrically operated hoists, and its object is to provide a novel form of brake adapted to prevent the load from falling when the motor is de-energised either intentionally or accidentally. The invention provides for an improvement in the brake, whereby the controller is effective in releasing the brakes only when there is current, in the motor circuit. It and so arranging the said coil and the brake-arms that the movement of the controller does not result in releasing the brake unless the magnet winding is energised; or, in other words, unless there is current in the motor circuit. Still more specifically considered the invention consists in making the members against which the cam on the controller shaft bears, not rigid with the brake-arms, but pivoted thereon, so as to form links or levers; the fulcrums of the levers being controlled by a magnet winding in the motor circuit.

Fig. 1 shows diagrammatically a side elevation of a hoist provided with a brake in accordance with the invention; Fig. 2 an end view of the brake, and also a diagram of the motor circuits.

The operation is as follows:—If controller C is moved to bring the movable contacts into engagement with the stationary contacts, a circuit is closed through the motor field, through coil A, and through the motor armature. The shaft *c* is rotated by the movement of the controller, so as to cause the cam E to push the stops *e e* apart, and since coil A is included in the

Fig. 1.



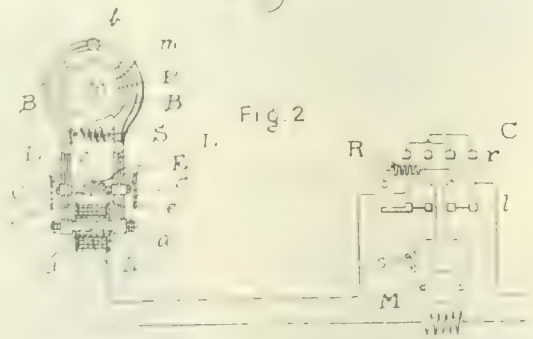


Fig. 2

motor circuit, the brake-arms B B will be disengaged from the pulley P, provided current flows in the motor circuit when closed. If, while the controller remains in this position, the current fails, for any reason, winding A will immediately release its cores *a a*, allowing the spring S to apply the brake.

NEW PUBLICATIONS.

"ENGINEERING MATHEMATICS SIMPLY EXPLAINED."

A Text-book for Apprentices, Students, and Engineers. By H. H. Harrison. Percival Marshall and Co. 1s. 6d. net.

The orthodox text-books on elementary mathematics, says Mr. Harrison, are usually crammed with academic exercises, the effect of which is to give a certain amount of dexterity in manipulation of symbols without a very clear comprehension of the principles involved. The aim of this volume is to supply the young engineer with a work, free from ambiguity, with just sufficient examples to elucidate the article to which they refer. The three opening chapters are devoted to arithmetic; the following sections deal with algebra, trigonometry, mensuration, logarithms and the utility of squared paper. In conclusion, a chapter is given on the calculus which will serve as an introduction to the more advanced studies. As a "first book" on an important subject it is well calculated to meet the student's requirements.

"ELEMENTARY ELECTRICAL CALCULATIONS."

By W. H. N. James, A.R.C.Sc., A.I.E.E., and D. L. Sands. Longmans, Green and Co. 3s. 6d. net.

Although not entirely free from blemishes, this handy text-book is one that is sure to find favour with young students. The authors are members of the tutorial staff of the Manchester School of Technology, and they present their subject in a manner that will be readily understood by first or second year pupils of electrical engineering. A number of worked out examples are included, and the set of unsolved questions will be studied with advantage by those preparing for the preliminary examination of the City and Guilds of London Institute.

"RESTRICTIVE RAILWAY LEGISLATION."

By Henry S. Haines. Macmillan and Co., Ltd. 5s. net.

This work, which is of American origin, is the outcome of a series of lectures delivered in the early part of this year at the Boston University School of Law. The writer's object is to present the manner in which legislation and judicial decisions have effected the operations of railway corporations in their relations to the public. Following the general statement of his case, the author discusses railway corporations, finance, construction, operation, traffic, rate-making, regulation of rates, state railroad commission, pending legislation affecting interstate commerce and state control of corporations engaged in public service.

"THE ALTERNATING-CURRENT CIRCUIT AND MOTOR."

An introductory and non-mathematical book for engineers and students. By W. Perren Maycock, M.I.E.E. Whittaker and Co. 4s. 6d. net.

Essentially for beginners, this work now in its second edition, has been subjected to careful revision, and an amount of new matter concerning single and polyphase motors has been added. As is now well-known, the work is intended for those who would find a difficulty in understanding the mathematical language in which the subject is generally clothed. A number of new illustrations appear and the book has been considerably enlarged.

NEW CATALOGUES.

Charles Winn and Co., St. Thomas' Works, Birmingham.—A substantial and well illustrated catalogue (D 38), of seventy-two quarto pages, is concerned with Winn's boiler and engine fittings, and on the title page we are reminded that the firm make a speciality of Siemens-Martin cast-steel valves. The list should be obtained and placed on file, as it cancels previous prices and dimensions. A good idea of the firm's works can be gathered from the views which appear on an early page, and the variety and extent of their output will be understood from the following summary of contents:—Ball valves, blow-off cocks and valves, blow-off bends, check valves, gun-metal cocks, expansion joints, exhaust relief valves, fire appliances, flanges, fusible plugs, hydraulic stop valves, injectors, indicator cocks, isolating valves, lubricators, pressure gauges and fittings, proving pumps, cast-iron stop valves, gun-metal stop valves, safety valves, scum cocks and valves, unions, water gauges and fittings, whistles. Attention is particularly drawn to the firm's heavy pattern parallel slide stop valve, which has an improved combination wedge and spring. Its absolute freedom from any tendency to stick when operated is a feature which is much appreciated by users. No. 1343D, with cast-iron body and cover, is designed for working pressures up to 160 lb., while 1341D with gun-metal body and cover deals with pressures up to 200 lb. per square inch. Prominence is also given to their asbestos packed automatic water gauges and protectors. The reason for naming these water gauges "Reliable" is sufficiently apparent, their claims being set out as follows:—Automatic valves in both steam and water arms, which instantly close upon the glass breaking; no loose ball in bottom arm; automatic valve attached to screw; cleaning plug; the automatic valves in no way interfere with the operation of blowing through; clear straight passages unobstructed by the automatic valves making false water-level impossible.

Lancaster and Tonge, Ltd., Pendleton, Manchester.—The latest description of the firm's Lancaster metallic packings is bound in a neat maroon cover, and has a cord by which it can readily be hung on a nail. Exceptional trouble has been taken with the sectional illustrations, for parts of which gilding is very effectively employed. The larger part is devoted to selected testimonials and a list of the users of these packings, but a careful description is also included, and at the end of the book is a useful table with dimensions of stuffing boxes. In stating the advantages of their packing the firm remark that in the best existing forms of metallic packings hitherto made, the metallic blocks are kept in position against the rod by means of a number of very small springs which are troublesome to manipulate and easily lost, thus causing much inconvenience. In "The Lancaster" packings these are replaced by two springs which, completely encircling the blocks, press them to the rod with perfectly equal pressure, and not at points only, at the same time leaving them free to give with any oscillation which may occur owing to the rod being out of truth with the cylinder. Hence if properly lubricated, they will work with a minimum of friction, and keep the rod perfectly cylindrical and parallel.

PAGE'S WEEKLY

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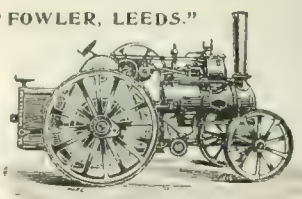
Manufacturers of

Traction Engines,



Steam Rollers, Portable Railways, &c., &c.

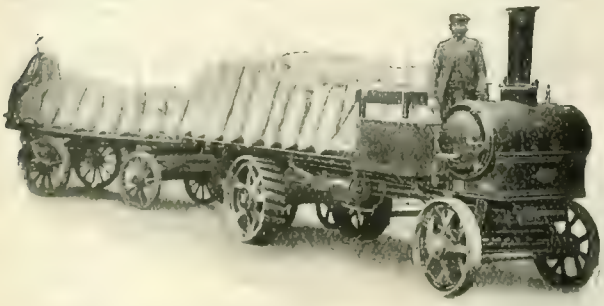
THE HUNSLET ENGINE CO., LTD.,
LEEDS.

MANUFACTURERS OF

TANK ENGINES
Of all Descriptions.

Designs and Specifications Supplied or Worked to.

Telegrams: "Engine, Leeds." Telephone: 528



This illustration is of a Steam Wagon to carry 6 Tons and haul 4 Tons on a Trailer.

THE . .
Yorkshire Patent Steam Wagon Co.

(Branch of Deighton's Patent Flue and Tube Company, Ltd.),

Pepper Road, Hunslet, Leeds.

MAKERS OF

STEAM MOTOR WAGONS

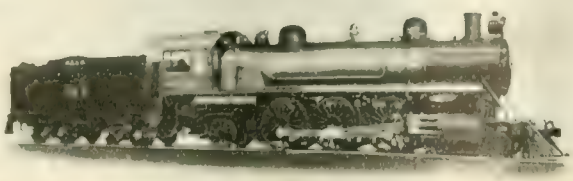
To suit any trade purpose, and to carry 3, 4, 5, and 6 tons.

Full particulars on application.

BALDWIN LOCOMOTIVE WORKS.

BROAD AND NARROW GAUGE **Locomotives** SINGLE EXPANSION & COMPOUND

Mine, Furnace and Industrial Locomotives.



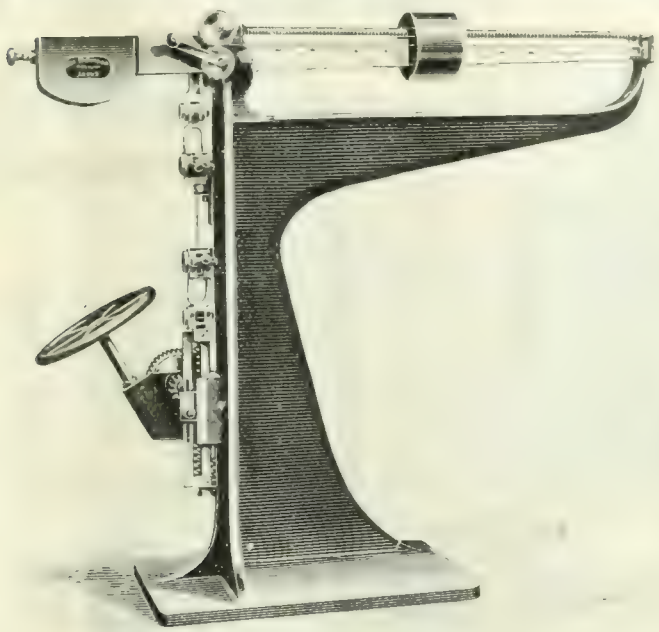
Electric Locomotives with Westinghouse Motors and Electric Trucks.

Burnham, Williams & Co., Philadelphia, Pa., U.S.A.

Cable Addresses: "Baldwin, Philadelphia" and "Sanders, London." General Agents: SANDERS & CO., 110, Cannon St., London, E.C

PAGE'S WEEKLY — Miscellaneous

Denison's SINGLE LEVER Wire Tester.



This apparatus is arranged for ascertaining the tensile strength of small wire, and is very accurate.

NO LOOSE WEIGHTS
ACCURATE EXTENSION GAUGE.

Capacity	1,000 lbs. avoir.	(1)
..	1,250	(2)
..	1,500	(3)

The poise weight carries a vernier to show single pounds

RAPID IN USE.

PATTERN B.

SAML. DENISON & SON, LTD.,

Hunslet Moor,

Telegrams: "WEIGH. LEEDS." Near LEEDS.

"VALOR" PATENT WASTE OIL FILTER.

BEST AND MOST EFFECTIVE IN THE UNITED KINGDOM.

For thoroughly cleansing dirty oil so that it can be re-used.

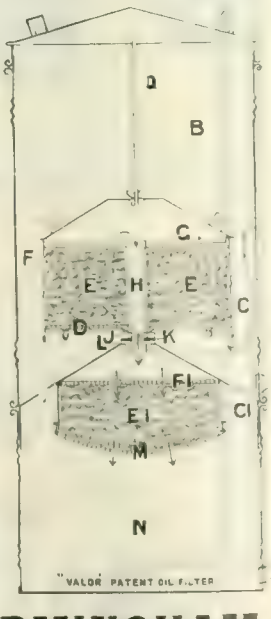
NO CHANCE FOR ARGUMENT TO YOUR PROFIT AND ADVANTAGE.

It saves your oil. It saves your money WHAT MORE DO YOU WANT?

Use the "Valor" Patent Oil Filter which will Repay its Initial Cost in a few weeks.

Cases Free and Carriage Paid to any Railway Station in England and Wales.

No	To Filter per week. Approx. Gallons.	Capacity. Gallons. Filtered Oil.	Dirty Oil.	Height. Inches.	Diameter. Inches	Price
1	2 to 4	18		24	9	39/-
2	3 to 6	2	4	28	12	46 6
3	5 to 10	4	7	32	12	50/-
4	12 to 24	6	8	36	14	75/
5	15 to 30	12	16	42	18	100 -
6	20 to 50	12	24	48	18	120 -



THE VALOR COMPANY, Ltd., ROCKY LANE, ASTON CROSS. BIRMINGHAM.

PAGE'S WEEKLY — Miscellaneous

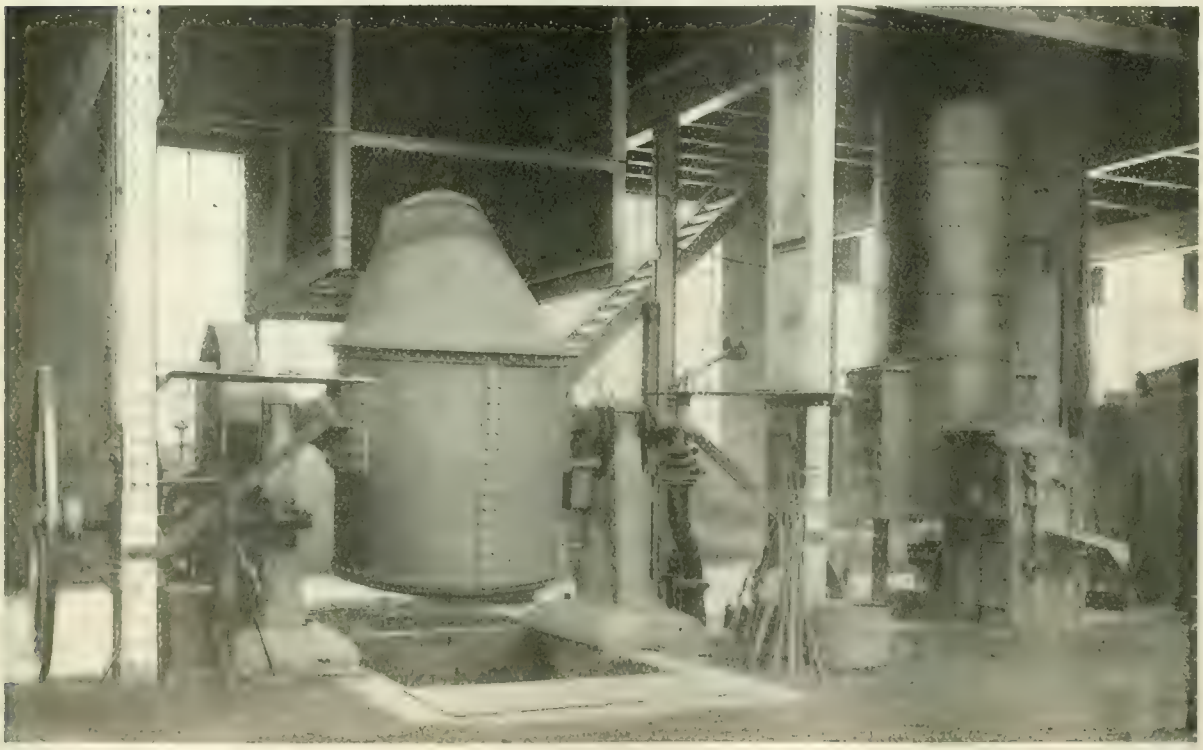
SMALL BESSEMER PLANT

(UNCKENBOLT SYSTEM)

For the Production of Steel and Iron Castings of Highest Qualities,

as in use at the

North German Lloyd Repairing Works, Bremen.



REFERENCES:—

THE STETTIN VULCAN CO. STETTIN-BREDOW
THE BELGIAN CO. LTD. BRUGES
THE WESER CO. LTD. BREMEN.
NORTH GERMAN LLOYD REPAIRING SHOPS BREMEN
FREDERICK KRUPP, LIMITED, ESSEN.

Cost of Plant and License depends on the Particular Requirements of the Works.

For full Particulars and permission to see Plants in Operation, apply to –

Paul J. Mallmann, M.A.,

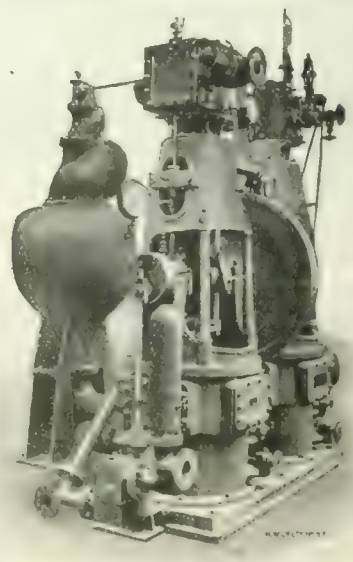
110-118, Victoria Street, LONDON, S.W.

PAGE'S WEEKLY **Condensing Plant**

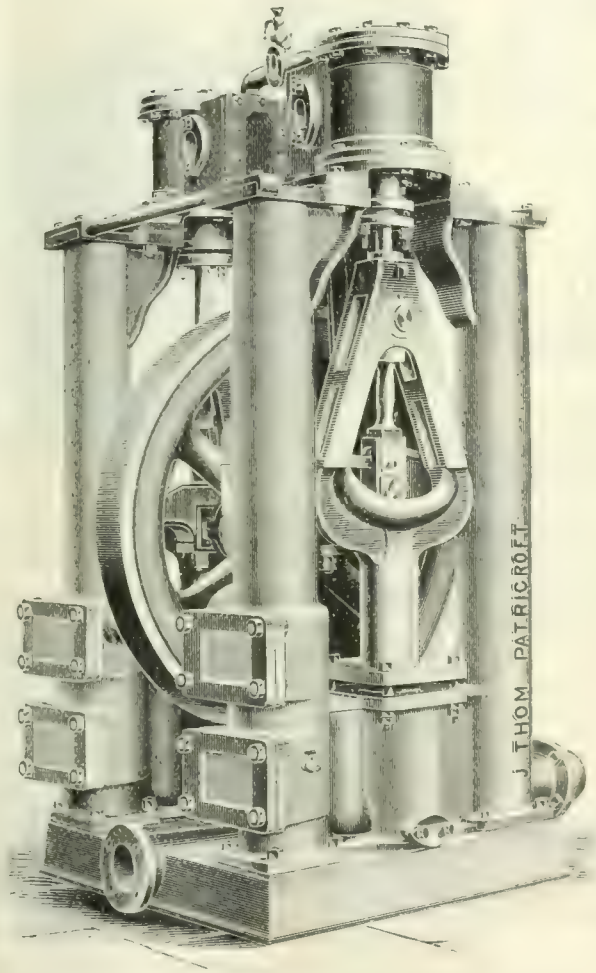
THE MIRRLEES WATSON Co. LTD GLASGOW.

LONDON OFFICE 158 GRESHAM HOUSE OLD BROAD STREET EC

CONDENSING PLANT FOR HIGH VACUUM



STEAM PUMPS



"Cameron" Type of Double-Acting Steam Ram Pump.

THE CHIEF ADVANTAGES of this Pump are that it is

COMPACT,
SIMPLE,
SUBSTANTIAL.

It is specially designed for boiler feeding. The columns which support the steam cylinders act as air vessels for the pump. All the bearings are of gun metal, and are adjustable. It is fitted with gun metal valves and seats, which are easy of access. Suitable for boiler pressures up to 120 lb. per sq. inch.

JOHN Z. THOM,

PATRICROFT, near MANCHESTER.

PAGE'S WEEKLY Electrical Apparatus

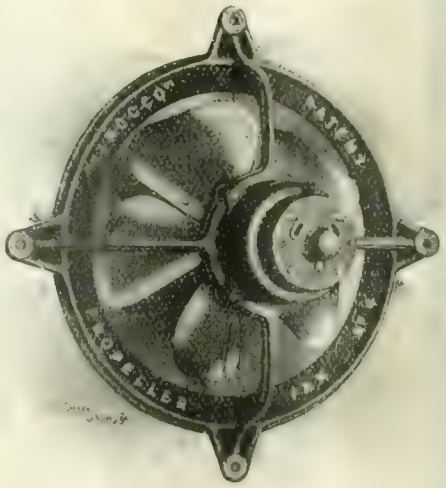
HIGHEST AWARD, GRAND PRIZE, ST. LOUIS EXPOSITION, 1904.

On Admiralty and War Office Lists.

"SIROCCO" FANS Propeller Type.

ELECTRIC OR BELT-DRIVEN.

The design and arrangement of the blades are such that the **"Sirocco"** Propeller Fan **will propel air** with equal efficiency **either outwardly** or **inwardly**, according to the direction of the rotation.



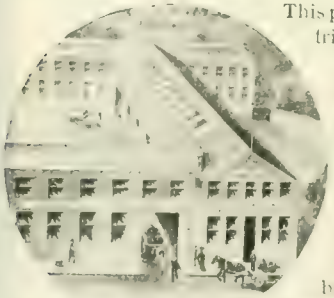
DAVIDSON & CO., LTD.,

"Sirocco" Engineering Works, **BELFAST.**

ALSO AT

13, Victoria Street, Westminster, LONDON.
37, Corporation Street, MANCHESTER.
115, Hope Street, GLASGOW.

Sole Representatives for the Continent of Europe: **WHITE, CHILD & BENEY, Ltd.,** 62 and 63, Queen Street, Cheapside, London, E.C.



This picture represents an Electrical Engineering Works in Yorkshire, which is specially laid out for the manufacture of Dynamos, Motors, Switches, and Switch boards. Everything is of the best; and prices are the lowest possible, consistent with best material and workmanship.

Note the Name and Address:

T. W. BROADBENT,
Victoria Electrical Works,
EAST PARADE, HUDDERSFIELD.

Write for Prices and Particulars
. . OF OUR . .
NEW "STANDARD" MACHINES.
They will interest you.

Dynamos **"P.D.M."** Motors

BEST MATERIAL, WORKMANSHIP, AND DESIGN.

PHŒNIX DYNAMO MFG. CO., Ltd.,
Thornbury Works, **BRADFORD.**
LONDON OFFICE: 17, Victoria St., Westminster, S.W.

Contractors to H.M. Government.

BRADBURY & CO., LTD.

Capstan Lathes and Labour Saving Tools.

WELLINGTON WORKS, OLDHAM.

Lists Free.

GREENWOOD & BATLEY, Ld.

LEEDS.

Machine Tools.

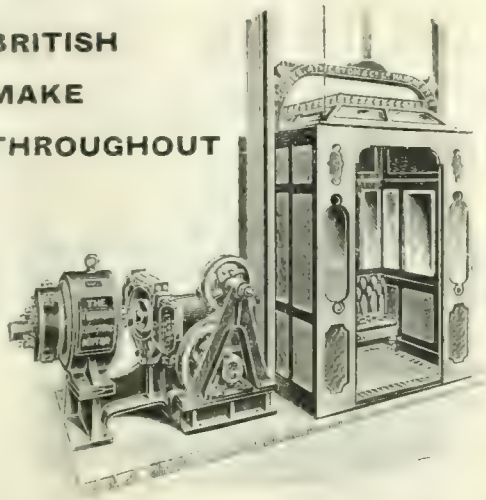
Dynamos & Motors.

De Laval's Patent Steam Turbines.

PAGE'S WEEKLY — Electrical Apparatus, &c.

ELECTRIC LIFTS

BRITISH MAKE THROUGHOUT

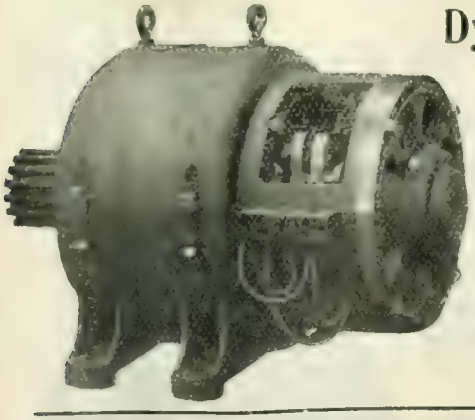


GOODS OR PASSENGER,
HAND-ROPE OR
CAGE-SWITCH CONTROL.

Reliable,
Durable,
and of Simple
Mechanical
Construction.

TURNER, ATHERTON & Co., Ltd.,

Head Office and Works, DENTON, MANCHESTER.



Dynamos
AND
Motors
for all
purposes.

NEWTON
BROS.,
DERBY.

JOHN GIBBS & SON

Ventilating Engineers,

80, JUKE STREET,
LIVERPOOL.

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SEE OUR ILLUSTRATED ADVERTISEMENT NEXT WEEK.

PAGE'S WEEKLY Time Recorders

EMPLOYERS OF LABOUR

Can save at least 5% ON THEIR WAGES BILL, and thousands of employers do so by the use of the

"Dey" Time Registers

which are automatic machines for registering the hour and minute at which Employees start and finish work,

and, with the New Attachment provides, in addition to the weekly time and wages sheets, the CARD SYSTEM for COST KEEPING.

The "DEY" combines on **THE ONE MACHINE** the good points of all other Automatic Time Recorders on the market.

They are of British Manufacture Throughout.

They are absolutely the best Time Recorders in the World.

They are the cheapest up-to-date machine on the market.

They are guaranteed perfect in every detail.

THEY COMPEL PUNCTUALITY.

The "Dey" time and wages sheets combined do away with time books, wages books, and save 90% of clerical work. They are adaptable to every requirement, no matter how complicated.

A firm using 15 machines writes: "We shall be sorry when we change the boiler-shop machine, as it was one of the earliest, and has had the roughest of usage together with the maximum of vibration, and rudest of shocks; but it has gone on working the whole time (nearly six years) night and day, and when it goes to you for repairs, it will be the first time it has been in the infirmary.

Full particulars from the Patentees and Manufacturers:—

HOWARD BROS.,

40, Paradise Street, LIVERPOOL.

TELEGRAPHIC ADDRESS "GONNEZ, LIVERPOOL." TELEPHONE 715 LIVERPOOL

London Offices: 100b, Queen Victoria Street, E.C.

TELEGRAPHIC ADDRESS "COUNTAIRE LONDON." TELEPHONE 767 BANK

PAGE'S WEEKLY

Printing, &c.

PAGE'S WEEKLY **Boilers, Pumps, &c.**

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